Concrete

Vol. 30 Chicago, June, 1927 No. 6

The A. B. C.'s of Good Concrete

Quality of Aggregates Is Important Factor in Making Good Concrete—Some Simple Field Tests for Aggregates —How to Take Aggregate Samples for Testing—Some Points to Watch

Part I—Field Tests for Aggregates

ONLY a few materials are necessary to make concrete. If gravel or rock is combined with sand, cement, and water in the right amount, good concrete can be made. But it is necessary that *all* the materials used be of good quality and that they be correctly proportioned.

Cement is a standard product. All of it, as purchased on the open market, meets the standard specifications of the American Society for Testing Materials. Properly handled, all cements available will make quality concrete.

The first requirement then, in making good concrete, is to be sure that the aggregates—that is, the sand and the stone or gravel—to be used are of good quality. Their importance is shown by the fact that they comprise by far the greatest volume of materials used in concrete.

On most jobs the requirements for both the fine and the coarse aggregate are definitely fixed by the specifications, but even then it is sometimes difficult to tell offhand whether or not the sand and stone available meet the demands of the specifications. It is the duty of both the engineer or inspector and of the contractor to be *sure* that the materials they intend to use will make good concrete. The general requirements for all aggregates are that they be clean, hard, durable and dense.

Some experienced concretors will say that they can look at a pile of sand or gravel and pass on its quality. Perhaps they can in some cases, but it is better to be absolutely certain, especially when some simple field tests that will settle the matter can easily be made.

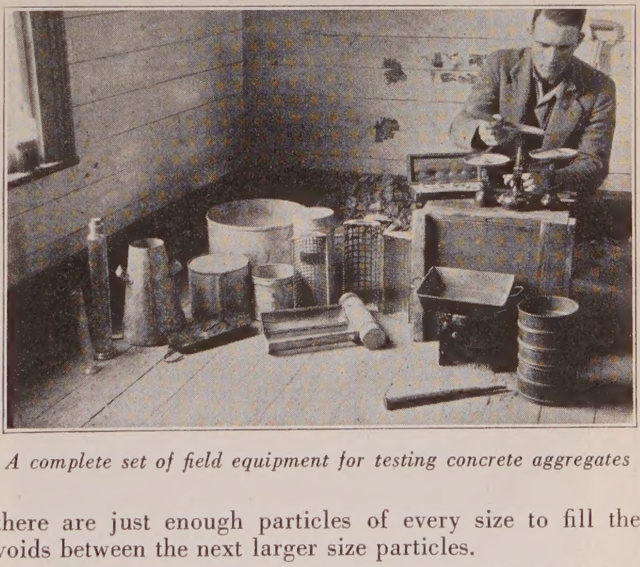
More than a visual examination is needed to pass on aggregates. It is not enough simply to take a handful of sand or pebbles, rub it between the fingers and then "guess" that it is all right. There are a number of tests that give reliable information as to quality. They are easily made with simple equipment. Then, if the suitability of the material is still in doubt, it is well to take a representative sample and send it to a laboratory for tests.

The contractor or products manufacturer or the inspector should be prepared to make these tests. Only a small amount of equipment is needed and the tests are quickly and easily made.

Aggregates are divided into two general classes—fine and coarse. "Fine" aggregate is that which passes a ¼-inch screen. Usually it is sand. "Coarse" aggregate is that retained on a ¼-inch screen. Usually it is gravel or crushed rock.

Grading of Aggregates

Is is important to all types of concrete work, whether products or mass work, that the aggregates be "well graded"—that is, that there should not be too many particles of either the smaller or the larger sizes. There should be some of *all* the sizes from the coarsest to the finest. The ideal grading for aggregates is that in which there are just enough particles of every size to fill the voids between the next larger size particles.



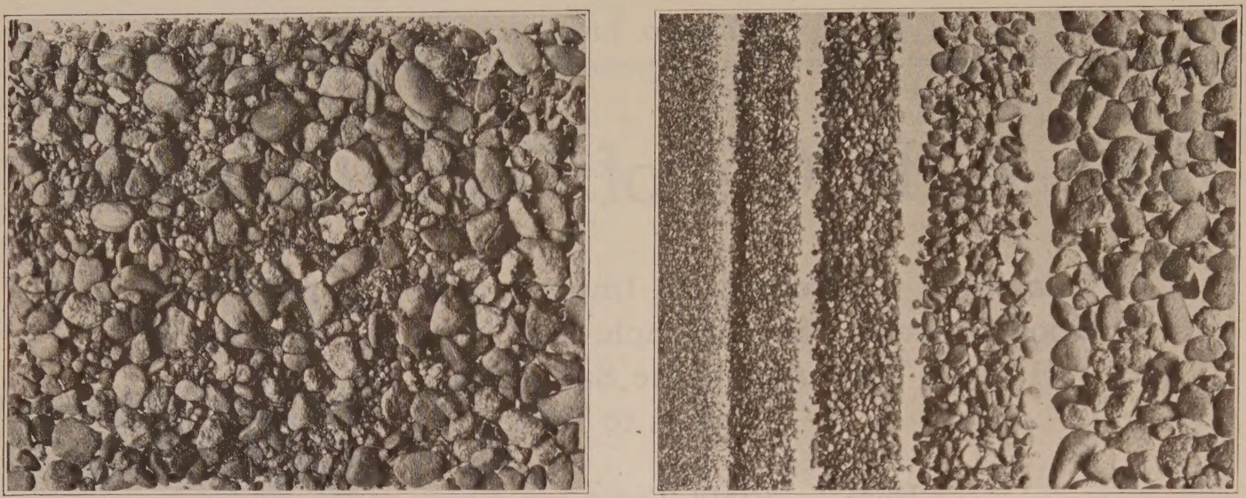
A complete set of field equipment for testing concrete aggregates

It is difficult to tell just by a glance at a pile of sand or gravel or rock whether or not it is well graded. The best way to find out is to screen a sample of the material through different size screens and determine what proportion of the sample is held on the different screens. Such screens are available in convenient sizes and are nested so that they can easily be carried to the job.

This matter of grading of aggregates has an important effect on the workability of concrete and will be discussed again in a later article. It also affects the volume of concrete secured with a given amount of aggregate and this feature will also be described in a later article.

Fine Aggregate

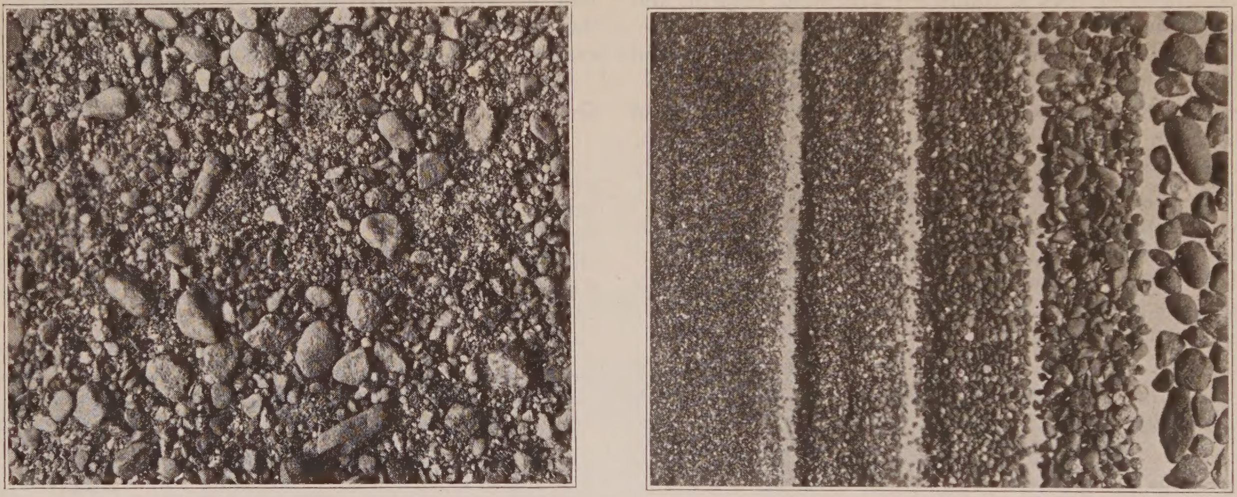
Of all the factors that cause poor concrete, probably the greatest number are in some way tied up with the quality of the sand used. The selection of good sand is the



An actual, full-size sample of coarse sand

Same sample screened

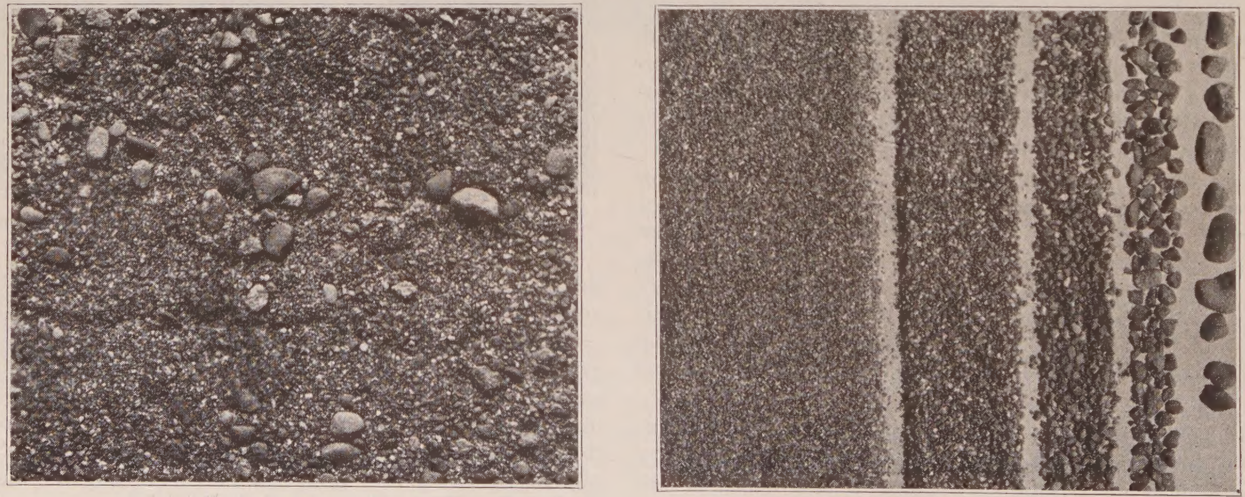
In the panel to the right the grains have been separated to show the proportion and range in size of particles. This is about as coarse as sand should be for use in concrete. A harsh mix that requires careful placing in the forms, but giving good strength, results



A sample of medium sand, in full size

Same sample screened

In the panel to the right the grains have been separated to show the proportion and range in size of particles. This is almost an ideal sand for use in concrete, containing the same volume of grains of different sizes



A full-size sample of fine sand

Same sample screened

In the panel to the right the grains have been separated to show the proportion and the range in size of particles. This sample has a large proportion of fine grains and is about as fine as sand should be for use in concrete to obtain best results first rule for making good concrete.

Sand may be unsuitable for use because:

(1) It may be too fine or otherwise poorly graded.

(2) It may be dirty.

It is particularly important that the fine aggregate be well graded, as shown in the accompanying illustrations.

The grading of sand can be tested roughly as follows: Sift a handful of dry sand on a No. 30 sieve. If it is a good concrete sand, the sieve will divide it roughly into two equal parts, the larger fraction being held on the sieve. If more than half of the sand goes through the sieve, it is too fine. Fine sand causes many difficulties. More mixing water is needed; the strength of the concrete is reduced, and the surface of the concrete is affected.

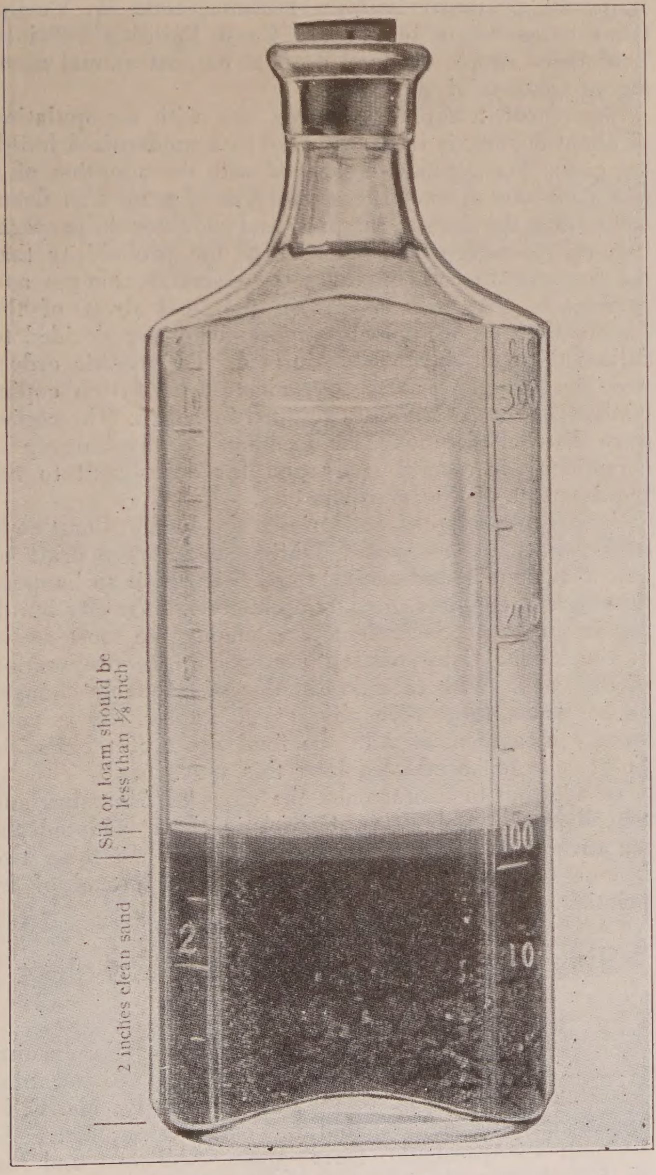
Five per cent should be the limit for material passing the 100-mesh sieve. It is well to check up on the grading of the sand frequently by sieve tests if good concrete is wanted.

Sand may be unsuited for concrete work because it is dirty. It may contain too much silt or it may contain dangerous organic matter. Fortunately there are two very easily made tests that will give reliable information on these questions.

The Silt Test

The silt test is made by placing about two inches of the sand to be tested and an equal amount of water in a 12-ounce graduated prescription bottle as illustrated. Shake the bottle thoroughly and allow it to stand until the water is practically clear. The silt will settle on top of the sand. The line between the sand and the silt is clearly visible and the volume of the two may be compared.

If the silt over the sand is more than ⅛-inch deep, the sand should not be used unless laboratory tests show that it is suitable.



Test to determine the quantity of silt or loam in sand

The Shale Test

Sometimes otherwise suitable sand is questioned because particles of shale or other light materials are present. It is difficult to tell by looking at the sand how much shale is there. This also can be determined by a simple field test.

The sand is immersed in a liquid of such specific gravity that the shale and other light particles will float while the good aggregate will sink. Zinc chloride is commonly used for this purpose, but any liquid with a specific gravity of about 1.95 will do as well.

Screening coarse aggregate to determine grading

A portion of the sample, carefully dried, is placed in a pan containing the liquid and shaken at least five times. The lighter or floating particles are then skimmed off. This process is repeated until all the shale or light particles are removed. Their volume is then compared with the volume of the sand and if too great a proportion of light particles is present, the sand should be washed before it is used.

The Colorimetric Test

Organic impurities in sand are discovered by the colorimetric test.

A 3 per cent solution of sodium hydroxide (NaOH) is needed. It may be made by dissolving one ounce of sodium hydroxide crystals in 32 ounces of water.

Fill a 12-ounce graduated prescription bottle to the 4½-ounce mark with the sand to be tested. Add enough of the 3 per cent solution of sodium hydroxide until the sand and the solution together will amount to seven ounces. Shake thoroughly and let stand for twenty-four hours.

If the liquid above the sand is clear or has a light yellow color, there is not enough organic matter to injure the concrete. If it is light brown or darker, the sand should be tested in the laboratory before it is accepted for use.

Experiments have shown that sands which show up dark in the colorimetric test cause considerable reduction in the strength of concrete. Shades darker than straw color reduce the strength of the concrete from 15 to 50 per cent. Very dark tests often show even greater reductions in strength. The materials for making this test can be bought at any drug store for a very small sum.

Coarse Aggregate

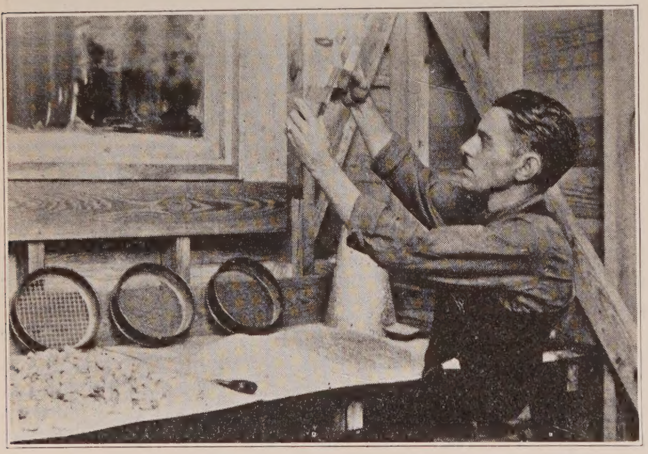
In general, the same requirements hold for coarse aggregate, as for fine aggregate. It must be clean, hard, free from foreign materials such as leaves, sticks, chips, etc., and it must be well graded.

Usually coarse aggregate is delivered separately, and is combined with the sand in the mixer. Sometimes pit run aggregate, in which sand and gravel are combined in the pit is used. In such a case especial care must be exercised that the material is well graded and that it is free from silt or organic matter. Under no conditions should it be used without making the tests described above.

Usually if coarse aggregates such as crushed stone or gravel are bought from quarries, pits or building material dealers, they are suitable for use. Sometimes it is well, in such cases, to buy several of the commercial sizes and combine them to get better grading than is characteristic of commercial coarse aggregate.

In handling coarse aggregate on the job, certain precautions are necessary. The site selected for aggregate piles should be cleaned of all weeds, rubbish or loose earth before the material is dumped.

Separation of the different sized particles may be largely prevented by building the base of the storage pile to its full diameter, then putting on successive layers as a haystack is put up, instead of building the pile as a cone and dropping each bucketful on the peak. This last method allows the large stones to roll to the bottom so that the top of the pile will lack the large sizes.



Interior of a field laboratory. The inspector is making a colorimetric test for sand

Taking Laboratory Samples

In cases where the field tests described indicate a doubt as to the value of the aggregates, a *representative* sample of the material should be sent to a laboratory for test to make the final decision.

The size of the sample will, of course, depend on the nature of the material and on the scope of the tests to be made. Generally a sample of fine aggregate should contain not less than 50 pounds and a sample of coarse aggregate not less than 100 pounds.

Care must be taken to get a representative sample. The sample to the laboratory should be taken from a selected batch of material four times as great. It is reduced by "quartering," that is, by thoroughly mixing, dividing into quarters and eliminating diagonal quarters. This operation is repeated until the sample is reduced to one quarter its original size.

In sampling the open face of a pit, the best method is to scoop vertical troughs at equal intervals along the face, placing the material taken from each trough on a canvas and quartering it down to the desired size.

When samples are taken from loaded cars, it is necessary to do quite a bit of digging to get a sample that is truly representative of the material in the car. A good method is to dig holes two or three feet deep at several points in the car, and, starting at the bottom of the hole, drag the point of the shovel up the side. The samples thus taken from each hole should be mixed and the total sample quartered down to size.

Having determined the quality of the aggregates and found them to be acceptable, the first important step in the making of good concrete has been taken. The next step is proportioning and one of the important points in proportioning is to allow for the bulking effect of moisture. This subject will be covered in next month's article.

Louisiana City to Adopt Pacific Coast Building Code

It is not improbable that the city of Shreveport, La., following in the footsteps of Sacramento, Calif., will adopt the proposed uniform building code for Pacific Coast cities before the Pacific Coast Building Officials' Conference adopts the final draft at its next annual meeting in October of this year.

Shreveport, a rapidly growing city with a population of about 80,000, is in urgent need of a modernized building code. The committee charged with the adoption of a new code saw at once the advantages of a modern document along the lines of the proposed code now in preparation on the west coast. Because of the probability that the Sacramento code includes the essential changes and corrections that will appear in the final draft of the Pacific Coast code, the Shreveport committee decided to follow the Sacramento code instead. Telegraphic orders were accordingly sent to Sacramento, and fifteen copies of that code were promptly shipped in return. The copies were distributed among the members of the Shreveport committee for careful study and for adjustment to the requirements of the Louisiana city.

Sacramento adopted and printed the Pacific Coast code in February of this year. While the tentative draft of that document is undergoing some changes, it so happens that the city engineer, the city architect and the city building inspector of Sacramento are among the most active of the Pacific Coast officials engaged in the preparation of the code. With their knowledge of probable changes to be made, they were able to give their city a code closely in agreement with the final draft of the Pacific Coast code to be adopted later this year.

In addition to Sacramento, the cities of Alhambra and San Bernardino, both in California, have adopted the tentative draft of the Pacific Coast code. In these two instances the adoption was by reference instead of by printing.

Slag Association Members Re-elect Officers

The following officers were re-elected for the ensuing year at the tenth annual meeting of the National Slag Association held in Cleveland, Ohio, recently: Mr. C. L. McKenzie, president, Pittsburgh, Pennsylvania; Mr. C. E. Ireland, Vice-president, Birmingham, Alabama, and Mr. H. J. Love, Secretary-Treasurer, Cleveland, Ohio.

Field Control of Concrete on St. Claire Realty Building

A Description of the Field Control Methods Used—Difficulties Overcome—Tables of Resulting Strengths

By W. H. PHILLIPS

CONCRETE designed for a strength of 2,000 lbs. per sq. in. at 28 days, but which averaged about 2,250 lbs., was placed in the structural frame of the new St. Claire Realty Building, at San Jose, Calif. The writer was the engineering inspector on the work, representing Weeks & Day, architects and engineers, of San Francisco.

Water Control

The proper water content was maintained by making a mark in a barrel and filling the barrel to the mark. The mark was set by trial so as to give a slump of 5 inches with the standard batch used. Auxiliary marks were made for use in controlling the slump when the moisture content changed.

A 3-inch pipe with a lever gate-valve led from the barrel to the mixer. The concrete mixture was about the same throughout the building; it consisted either of 1 part of cement, 2 parts of fine aggregate and 4.65 parts of coarse aggregate (field measurements) or 1 part of cement, 1.62 parts of fine aggregate and 4.38 parts of coarse aggregate (dry and rodded.)

The fineness modulus of the fine aggregate was 2.40; that of the coarse aggregate was 6.80.

The final mixture was designed by taking from Abrams' "Quantities of Materials for Concrete" the proportions of materials for a 2000-lb. concrete and for the sizes of fine and coarse aggregates which were readily obtainable. The tables indicated a required fineness modulus of 5.65. With

The St. Claire Realty building, a reinforced concrete structure on which field control methods were used the fineness modulus of 2.40 and 6.80 for the fine and coarse aggregates, respectively, the required dry and rodded volumes of aggregates were 27 per cent of fine and 73 per cent of coarse.

With the fine aggregate used, the dry and rodded volume was 93 per cent of the dry and loose volume, and the swell due to the moisture content averaged 15 per cent. From this it was determined that the loose volume of fine aggregate having the average moisture content was $\frac{1.62 \times 1.15}{0.93}$, or 2 parts.

The rodded volume of coarse aggregate was 94 per cent of its loose volume. The moisture content had no appreciable effect on its volume. From this the loose volume of coarse aggregate was found to be 4.38/0.94, or 4.65 parts.

Consequently the proportions based on field measurements were 1:2:4.65, by volume.

The concrete was mixed in the field in 3-sack batches, which, on the basis of the proportions just stated, required 3 sacks of cement, 6 cu. ft. of fine aggregate and 14 cu. ft. of coarse aggregate for each batch. One such batch produced 15.7 cu. ft. of concrete. Consequently a cubic yard of concrete in place contained 5.16 sacks of cement.

Difficulties Encountered

Among the difficulties to overcome in getting good results, the mental attitude of concrete workers (except the few old-timers who mixed concrete with a muck stick) is listed first. The day laborer is much more willing to work the stiffer consistency than the concrete workers are. Concrete finishers especially are opposed to stiff concrete. Both the concrete workers and the finishers object to the physical exertion required to get the best results from tamping.

Another difficulty, but one which some one in the material business should see and profit by, is to get material dealers to furnish materials which run reasonably uniform in regard to the sizes to be used.

On work of any considerable magnitude the coarse aggregate should be delivered in three sizes and the combining should be done on the job. Later this method could be extended to small jobs.

At San Jose we found that the cars of coarse aggregate did not come uniform, the loading belts evidently having delivered unevenly. From cars which did run uniform there was difficulty in getting a uniform run of material to the buggies, for in dumping from the trucks to the bunkers the larger particles would outrun the smaller ones down the steep slopes of the material piles. Thus some buggy-loads were considerably coarser than the average. This sudden change in the size of the aggregates affects the workability of the concrete, and if not watched carefully it will result in changing the water-cement ratio and thus affect the strength of the concrete.

To overcome these difficulties the coarse aggregate should be delivered in three sizes and the proper combination made on the job. The usual variations which occur in the fine aggregate do not disturb the workability of the concrete.

So much of the inspector's time is required at the mixer that there is not sufficient time left for attention to the placing of concrete.

Another difficulty which will often arise and which must be heeded by those who are interested in good concrete will be attempts of contractors to obtain 2000-lb. concrete with the leaner mixtures without constantly checking the fineness modulus of the aggregates, and constantly checking the workability by the slump test or by the flow test.

Two Minute Mix

A point of interest is that during the concreting of walls and columns the material could not be handled as rapidly on the concreting deck as when placing beams and slabs. Consequently the batch was kept in the mixer for two minutes while walls and columns were being concreted. This two-minute mix was more workable than a batch of the same quantities of materials mixed for only one minute.

Tables I and II show the results of the 7-day and 28-day tests, respectively.

Weeks & Day, of San Francisco, were the architects and engineers on the St. Claire Realty Building. Cahill Brothers, of San Francisco, had the general contract.

TABLE I

Result of Compressive Tests On 6x12-inch Cylinders
7 Days Old

Cylinder Number	Slump Inches	Compressive Strength Lbs. Per Sq. Inch
9	4	1953
11		1544
13	(wet batch)	828
15	5	1392
17		1293
19	(wet batch)	1171
21	(wet batch)	1011
23		1018
25	5	1240
27	5	1266
29	5	1488
31		1282
33	2 (Basement floor)	2081
35*	2	945

*Cylinder No. 35 was made from a batch containing 3.44 sacks of cement per cu. yd. of concrete in place. All other cylinders were from batches containing 5.16 sacks of cement per cu. yd. of concrete in place.

TABLE II

Result of Compressive Tests On 6x12-inch Cylinders
28 Days Old

Cylinder Number	Slump Inches	Compressive Strength Lbs. Per Sq. Inch
5	4	2202
6	4	1990
7	5	1674**
8	5	1993
10	5	2526
12		2562
14	(wet batch)	1787
16		1644
18		2682
20		2278
22	(wet batch)	1719
24	6	2027
26	5	2267
28	5	2420
30	5	2432
32	5	2172
34	2 (Basement floor)	3120
36*	2	1887

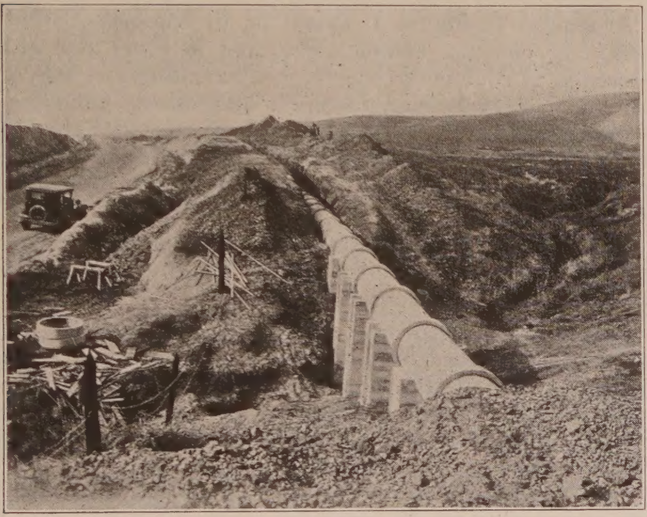
*No. 36 was from concrete containing 3.44 sacks of cement per cu. yd. of concrete in place. All other cylinders were from concrete containing 5.16 sacks of cement per cu. yd. of concrete in place.

**Cylinder No. 7 had an irregular end.

A 13-Mile Water Supply Concrete Conveying System

More Than 44,000 Feet of Concrete-Covered Steel Pipe and 18,000 Feet of Cast Concrete Pipe Used in Laguna Beach, Calif., Job

IN the construction of a 13-mile water supply line for the city of Laguna Beach, California, 18,000 feet of precast concrete pipe and 44,800 feet of steel pipe covered with a coating of concrete were used for 62,800 feet of the total project. Considerable attention was attracted to this job because of the unusual features worked out by the engineers. The pipe was covered with gunite in a central yard and moved to the job where the sections were joined by welding outfits working along the pipe trench.



An exposed section of the line, crossing an arroyo on saddles and piers of concrete

The pipe line extends from Corona Del Mar to Laguna Beach, for the most part running within sight of the ocean. The general topography of the land traversed by the pipe line is rolling and cut by deep arroyos necessitating some steep grades in the line and at places a suspended pipe bridge. Every one of these suspended sections was left uncovered to the elements.

The concrete-covered section of the line carries the water from Corona Del Mar to the highest point on a range of hills over which the line goes. This section of the line is under pressure. A 3/16-inch pipe in units 30 inches in diameter and 32 feet long was used for this section of the line.

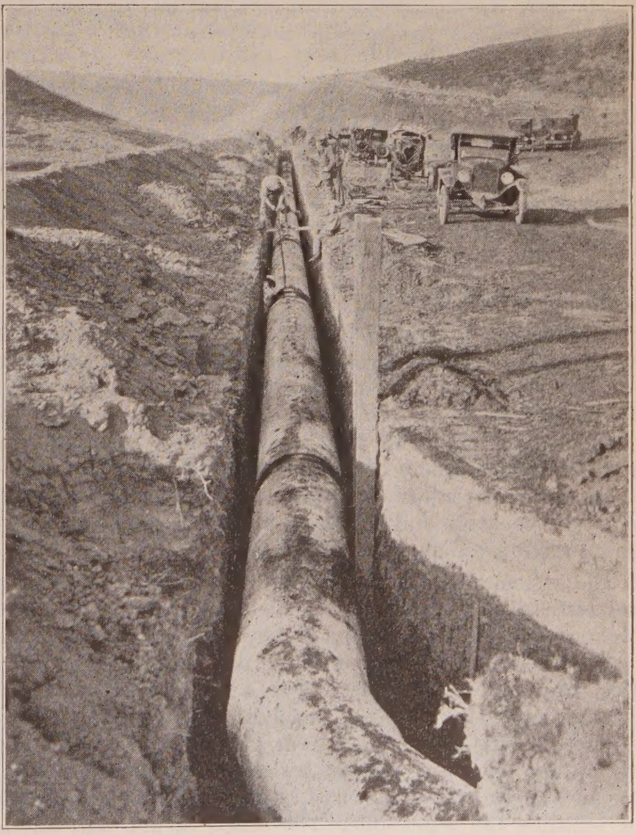
Steel Pipe Encased in Concrete

Contrary to usual practice, the units were all gunited in a central yard near Corona Del Mar and hauled to the job. To facilitate the work of guniting the units, the sections were laid across the yard in rows and as the guniting progressed, each section was rolled upon a pair of skids so that the units could be turned as the coating was applied by the gun operator. No attempt was made to recover the rebound from the gun but the skids were built higher as the rebound material increased under the units.

At the start of the operation each unit was covered with 14-gauge American Steel and Wire mesh with openings 2½ inches by 5 inches. Upon and through this mesh the gunite was shot until a total thickness of ⅞ of an inch was attained. The units were covered in a single operation rather than by coatings applied in several operations. After the units were covered with gunite, a covering of burlap was laid over them and kept wet for 10 days to insure proper curing. Each section, when covered with gunite and ready for hauling to the job, weighed about 4400 pounds. In spite of the large sections and weight, good speed was attained in the yard. With two and three guns working, an average of 50 sections a day was attained. In all 1400 units of pipe were gunited. A 1-part-cement-to-4-parts-sand mix was used.

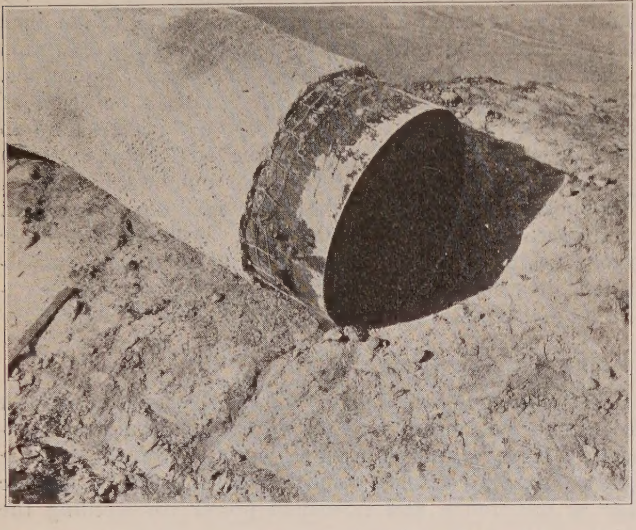
Joining Pipe Sections

The procedure followed in joining the pipe sections in the trench was unusual. Probably the most unusual departure from ordinary practice was the use of portable electric welding machine outfits that traveled along the side of the trench and furnished power for welding the



The joints were welded with a portable electric welding machine. After the joints were welded, they were encased in concrete applied with a portable guniting outfit units together. The sections were lapped one inch and tacked by welding. In addition to the electric welding outfit an acetylene torch was also used. After the sections were tacked into correct alignment and grade, the laps were full joint welded either by the electric or acetylene method.

When the units had been welded, other crews concreted the joints between sections. Reinforcing was first placed around the pipe joints and the joint covered with a ⅞-inch coating of gunite. The mix used in the field for covering the joints was the same as that used in the yard—1 part cement to 4 parts of sand. The pipe treated with gunite and laid in the trench in the method described was tested for 155 pounds per square inch pressure before the sections were declared usable.



A close-up of the steel pipe covered with gunite in the central yard. Note the exposed reinforcement which was later joined to similar reinforcement in the next section

Included in this pipe job was about 18,000 feet of precast concrete pipe and 44,000 feet of cast iron pipe. The cast iron pipe was used under railroad tracks and highways. At one point along the 13 miles of system where the line crossed a bay a cast iron pipe line with flexible joints was placed 27 feet under water. This underwater section was about 500 feet long.

Unusual Conditions

An interesting feature of the job was the sections of line crossing deep arroyos. Over all these cuts, concrete covered steel pipe and precast concrete pipe was used. These sections of the line were left uncovered and will be exposed to the full force of sea shore weather. In another section where the line crossed a wide marsh entirely different conditions of exposure will be encountered. Concrete footings and saddles were used in all these exposed sections of the pipe line.

The system was carefully worked out for capacity and exposure with a view to construction and maintenance economy. It is believed that the system will care for the rapid development going on along this coast from Corona Del Mar and Arch Beach for many years to come. Enough water can be taken through the mains, if need be, to supply 175,000 persons. It is understood that the city of Laguna Beach is paying for 48 per cent of the cost of this system through a bond issue voted for the purpose of building the water line. The other 52 per cent of the cost is being carried by the Irvine Ranch which will also be supplied with water from the line. The total cost of the line under the contract of the general contractors was approximately $500,000 exclusive of engineering. The entire water system ultimately planned for will be much more.

Engineers for the project were J. B. Lippincott, of Los Angeles and C. R. Browning of the large Irvine Ranch across whose property the line goes. H. W. Rohl of San Francisco was the general contractor. The steel pipe was furnished by the Steel Pipe and Tank Company of Berkeley. The cast concrete pipe was supplied by the Western Concrete Pipe Company of Los Angeles. The Cement Gun Company handled the work of guniting the sections in the yard and the joint work in the field.

Products Association Invites Non-Members to Summer Meeting

July 29th and 30th have been set as the dates for the mid-summer meeting of the Northwest Concrete Products Association. Astoria, Oregon, located at the mouth of the Columbia River, has been selected as the place.

A general invitation is issued to all engineers, architects, city officials, non-members, and to every one else interested in concrete products, their manufacture, sale or use. All products manufacturers and others interested, planning a trip to the Pacific coast during the coming summer, are urged to arrange their schedules to include attendance at this meeting. Ample hotel reservations will be available.

The business of specifications for all concrete products and the issuance of "Certificates of Quality" are among the principal items of special interest.

As an added attraction, it is planned to make this meeting a combined business and pleasure meeting. The beaches of the Pacific ocean are but a 30-minute drive from Astoria. A cool plunge into the breakers after the weighty matters of the convention are concluded, is an added inducement to attend this meeting.

The Northwest Concrete Products Association now lists among its members 42 operating products plants, manufacturing every kind and type of precast concrete unit. Concrete pipe is included as one of the principal products. The business coming before this convention consequently covers a wide and diversified range of subjects.

Tank Manufacturers Organize; Work Already Effective

What is believed to be the only organization of concrete septic tank manufacturers has been formed in Florida, to be known as the Concrete Septic Tank Manufacturers' Association of Florida.

Although but two months old the organization is credited with several accomplishments. New manufacturing and installation principles, effective since May 1, have been developed with the aid of the State Board of Health. At a meeting at Palm Beach on April 16th, the State Boards of Health and Plumbing were represented by Mr. E. L. Filby, Chief Sanitary Engineer of the State Board of Health. Mr. Filby made the principal address of the day, speaking on "Installation."

The object of the organization is the improvement and promotion of concrete septic tanks and co-operation with the State Board of Health and the State Board of Plumbing, as well as local boards and officials.

The officers are Mr. V. D. Chandler, West Palm Beach, President; Mr. E. F. Cook, Jacksonville, Vice-President; Wm. P. Workman, St. Petersburg, Treasurer, and James H. Williams of Fort Pierce, Secretary.

Some Suggestions for

Analyzing the Market for Concrete Specialties

The Profits in Specialties—The Problem of Choosing the Right Specialty—Roof Tile—Floor Tile—Garden Furniture—Manhole Block—Silo Staves—Garbage Boxes—Burial Vaults—Posts—Trimstone—Septic Tanks—Pipe —Final Considerations

ALMOST any manufacturer of concrete building units can add one or more specialties to his line without any injury to his established business, and by doing so increase very appreciably his total annual income.

The margin of profit afforded by most concrete specialties is somewhat more liberal than that which can be made on concrete block or tile. This does not mean that it is wise to substitute the manufacture of the average concrete specialty for the block business, because the volume of possible business with a specialty is usually considerably below that possible to the block business. But it does mean that an appropriate specialty can usually be added to an established concrete block business, and even though manufactured in comparatively small quantities, it will add a very nice chunk of money to the products man's total annual profits. Then, too, it should not be forgotten that there are times in nearly every block plant when business is dull. A properly chosen specialty can often be used to fill in these dull spots, and not only prevent a loss, but actually add to the year's total profits.

Choosing the Right One

Many of the failures in the manufacture of concrete specialties are the result of choosing the wrong one. What may work out very well for one products man, may be totally unsuited to the conditions under which another manufacturer may be working. Things can be sold successfully in small towns which would go begging in a city, and *vice versa*. The buying habits of one community might make impossible the sale of a product for which there was a strong demand in another almost identical community. All these things must be carefully considered if one's venture into the manufacture of a concrete specialty is to be a success. In some instances equipment manufacturers are prepared to give sound and unprejudiced advice on this question to their prospects, but more often the products man must make his own investigation and draw his own conclusions.

All this means that some sort of a market analysis is a tremendously important prelude to any attempt to engage in the manufacture of a concrete specialty. It is a thing you cannot afford to overlook, unless you are willing to gamble on the product you select. It is much better and safer to investigate first.

The two big questions to be asked (and answered) are:

1. Does my sales radius provide a sufficiently large market for the product in question to make the possible annual sale of it worth while?
2. What circumstances are there which will help or hinder me in the sale of the product to this market?

It is on the answers to those two questions that the decision as to the advisability of adding any specialty to your line should rest, and it is to help products men answer these questions that this article is written. The peculiar circumstances surrounding the marketing of various products will be considered for as many different types as possible, including the more popular specialties now on the market. While the points outlined will not necessarily constitute a complete or final treatise on the subject of market analysis for products manufacturers, they will, we hope, serve as useful hints to our readers in the solution of their individual problems.

Roof Tile

Concrete roof tile, because of their close and obvious relation to concrete block, are apt to be among the first specialties to be considered by a block manufacturer. The market for roof tile can generally be developed to very respectable proportions, and although the profit they yield is apt to be somewhat lower than with some other specialties, the volume in which roof tile can be sold usually offsets this disadvantage.

The total prospect list for a roof tile manufacturer is the total number of houses going up in his sales area. What part of this can be considered as a possible market depends upon several considerations, none of which should be overlooked.

Do builders in your community recognize the need of a fireproof roof? If not, you will have much educational work to do. Do slate, clay tile, composition shingles, or other permanent and fireproof roofing materials have any appreciable sale in your territory? If so, you will have less pioneering to do. If not, try and find out the reason. It may be one that will hinder your progress as well as that of these other roofing materials.

If the answers to these questions are satisfactory, you may fairly consider the following classes of houses as your prospects:

1. Houses built by realtors to sell to middle class tenants or better. The extra cost of a concrete roof can be added to the price and still help sell the house.
2. Houses built by people who habitually spend a little less than they could on anything they buy. Such people can add a concrete roof without altering their original plans. This group is hard to define, but in general it will be found to coincide with those who build houses a little above the average.
3. Reroofing jobs on old houses of distinctly superior type.

But—when you have counted your prospects, don't think you can sell them all. You may get five or ten per cent the first year if you hustle. And you can increase your sales from year to year if your products please. But it is necessary to market aggressively if you expect to get the lion's share of the business. You *may*,—but, other roofing materials will continue to be sold, and some of them aggressively.

Floor Tile

Concrete floor tile, while not widely manufactured by block makers, are nevertheless a very saleable product in many communities, and the few block makers we know who have equipped themselves to turn out good floor tile, have made money doing it. But remember this—a concrete floor tile must be a good one or it will not sell, for it must compete with very high grade tile, both of concrete and of other materials, which are made by exclusive tile manufacturers.

Concrete floor tile can be sold successfully only in a somewhat metropolitan community where the use of floor tile has already been developed and experienced tile setters are available. If the market has not been injured by the introduction of concrete tile of inferior quality, any such city ought to offer a good opportunity for this business.

Garden Furniture

Concrete garden furniture—urns, flower boxes, benches, sundials, bird baths, etc.—constitute one of the most popular side lines for block manufacturers. A reasonably good market for such specialties is fortunately available in almost every community. With the exception of a few large cities and misbegotten industrial villages, nearly every hamlet, town, and city throughout the land has a fair share of the attractive yards and gardens that are a necessary background for this kind of ornamental concrete.

Before venturing into the purchase of molds and supplies, however, the products manufacturer should make sure of these things:—

1. That there are enough homes with attractive yards or gardens in the sales area under consideration to constitute a sufficient potential market.
2. That the market has not been flooded with ugly or poorly made garden ornaments.
3. That there is not already an ample supply of good concrete garden furniture available in the market.

In the event that any one of these three statements does not apply, a very careful study of the whole situation ought to be made before going ahead. Success might be attained with either statement 2 or 3 not applying, but success under those conditions would be neither probable nor easy. But if all three statements do apply, it would be very difficult for any successful block manufacturer not to succeed, at least in some degree, in the manufacture of garden furniture.

Manhole Block

The manufacture of manhole block has been successfully engaged in by a considerable number of products manufacturers during the last few years, and now that machine manufacturers have put onto the market suitable equipment for turning out this specialty in quantity, it is probable that many more block makers will take on this line.

Two things determine the extent and nature of the possible market for manhole blocks:

1. Has your community a public sewer system which is being extended or repaired extensively enough to make manhole construction an item of any importance?
2. Is there any private use for manhole block in your community for the construction of catch basins?

If the answers to these two questions indicate a sufficient market, manhole block can, in all probability, be sold successfully. But if the plan is to dispose of them principally for municipal work, it would also be very important to find out whether or not there are any political considerations which would affect the sale of the block.

Silo Staves

Block makers whose market includes a considerable rural area often do a good business in concrete silos which are constructed of silo staves made in the products plant.

These conditions are essential to success with this specialty:

1. Reasonably prosperous farmers. (The prosperity or lack of prosperity on the part of your local farm implement dealers will give some line on this.)
2. The use of ensilage must be fairly well established. In other words, there must be silos already on the landscape.
3. The dairy business, whether side line or main line with the farmers, ought to be in reasonably healthy condition. For when a farmer sells his cattle, he ceases to need a silo.

Granted these conditions, the potential market can be measured by counting the number of owner-operated farms in the sales area that raise corn and have cattle but are either without a silo, or have one that has seen its best days.

With the farm market as a backbone for the business, it is also often possible to sell silos of special design to building material dealers, coal dealers, and even to concrete products manufacturers, for use in the storing of sand, gravel, coal, or other similar materials.

Garbage Boxes and Ash Receptacles

It is very difficult to secure any sort of ash receptacle or garbage box that will compare favorably with those made of concrete. As a result, the manufacture of these two related specialties has proven extremely profitable to those who have engaged in it under suitable conditions.

Three market conditions are necessary in order that concrete garbage boxes or ash receptacles may be successfully sold. They are:

1. Homes (houses or small apartments) located in districts served by alleys.
2. A reasonably good municipal or private system of garbage or ash collection.
3. An active health department that will not tolerate heaps of rubbish in the alleys.

The first two of these conditions are self-evident necessities. Some readers may feel that the third condition is not essential, however, and while this may be true in a strict sense it will nevertheless be found that it is very difficult to build up a good business in either of these two specialties where that condition is absent.

Granted these three conditions, the potential market may be counted as the total number of homes on alleys where garbage and ash collection is maintained, plus the number of new homes being built each year to which these conditions also apply.

Just what this means in actual sales is of course dependent almost as much on the manufacturer and his sales methods as upon anything else. Fortunately, however, we have available the figures of an actual manufacturer in a large mid-western city, and our readers will very probably find them interesting for purposes of comparison.

This particular manufacturer is located in a city which meets all three of the conditions considered as essential. His survey shows 225,000 homes that are possible prospects for both garbage and ash receptacles, making a potential market for 450,000 receptacles of both types. He also knows that 12,000 new houses are being built each year in his sales area that are also prospects for his products. He has already sold 85,000 receptacles in this market, and is now manufacturing and selling at the rate of 20,000 per year. As the figure stands he quite evidently has a bright future ahead of him, and the fact that he is planning a new plant for the manufacture of nothing but garbage and ash receptacles would seem to indicate that his own conclusions agree with this analysis.

Burial Vaults

Burial vaults are today regarded as more or less of a necessity in most communities, and as a result of this fact they offer a very fertile field of opportunity for most concrete products manufacturers. In spite of the almost universal demand, however, the products man contemplating entering the vault business ought to be reasonably sure that he has an opportunity to realize a fair profit out of the venture before he makes an investment in it.

There are four things that a prospective manufacturer of concrete burial vaults needs to know before going ahead with his plans.

1. Is the community normally prosperous—that is, prosperous enough so that the cost of a burial vault does not outweigh its desirability?

2. Is the number of deaths reported annually in the sales area sufficiently large to provide you a prospective market of the necessary proportions?

3. Are steel vaults now being sold in the territory? Are they being sold in any quantity?

4. Are concrete vaults being sold? If so, what proportion of the undertakers have established relations with the manufacturers of them?

Assuming that the answers to the first two questions are such as to warrant going into the business, the answers to the last two questions will furnish a gauge as to the amount of sales resistance to be encountered. If steel vaults are being sold, they can be replaced to a considerable extent with concrete vaults if the matter is gone about properly. The concrete vault generally sells for somewhat less than the steel vault, and it can be demonstrated to be superior. Undertakers are apt to appreciate the fact that, being on the spot, the concrete vault manufacturer can render them a degree of service they cannot hope to get from a steel vault manufacturer who may be 1000 miles away. The fact that steel vaults are being sold successfully definitely establishes the possibility of selling concrete vaults in the same territory with similar success.

Where concrete vaults are already being sold, the prospective manufacturer's chances of success will depend upon the thoroughness with which the field is already covered, and upon the relative merchandising ability and energy of the prospective manufacturer as compared with those already established in the territory. If investigation should disclose that the undertakers are not satisfied with the service they are receiving from present manufacturers, that of course would make an entry into the field comparatively easy. If on the other hand it should be found that the undertakers are well satisfied with the service they are receiving, that fact would greatly add to the difficulties of a newcomer.

Posts

There are two types of posts that seem to fit in well with the business of the average block maker—the ordinary farm fence post, and the smaller post used with a chain or wire to protect lawns.

If a products maker is located in a rural community he will of course be interested in the fence post business. About the only two questions he will need to ask himself in order to determine the possibility of a market are:

1. Is fencing common and necessary in his community, and is it kept up in good repair?

2. Have concrete posts been introduced into the community; and with what result?

If an inferior concrete post has been sold to farmers you are apt to encounter a deep seated prejudice against concrete posts which it may take some little time to overcome. But experience indicates that it can be overcome by tactful sales work over a period of a few years.

The smaller post used for protecting lawns can ordinarily be sold only in cities of fair size. Well kept lawns and parkways, and a sufficiently dense population to over-run them unreasonably, are the necessary components of the market for these posts. Wherever introduced they seem to become rapidly popular, as they are a distinct improvement upon either wooden posts or gas pipe.

Both of these types of posts are simple to manufacture, and it is somewhat surprising that more products makers have not added them to their lines.

Trimstone—Sills and Lintels

The manufacture of concrete trim stone is becoming of greater importance each year. It can be engaged in almost anywhere with some degree of success, and if a product of proper quality is produced, the business is nearly always profitable. Without careful craftmanship, however, it is difficult to make a success of the trim stone business.

Ordinarily the best place for the prospective trimstone manufacturer to start is with sills and lintels, and it is accordingly with the market for these two specialties that he will be chiefly concerned when he is making his plans for entering the business. Most communities will provide some sort of a market for concrete sills and lintels, but in order to determine just how extensive that market is, it is well to ask the following questions:

1. Are any stone sills and lintels being used in the prospective sales area? How many per year?

2. Is new construction of a type requiring stone or concrete sills and lintels (that is, masonry construction) going ahead at a rate that will provide a sufficient market?

3. Are stone sills and lintels selling at a price which can be beat with concrete?

If the answers to these questions are favorable, there is little doubt but that the manufacture of concrete sills and lintels will lead to a distinct advantage. As the market for sills and lintels is developed, it may develop that the community offers a market for a considerable amount of specially made trimstone of high quality. If a product as good or better for this purpose than the natural stone being used is made, there is no question but that some of the business can be secured. It will be an easy matter to add this line, after the manufacturer has once established himself as a manufacturer of sills and lintels.

Septic Tanks

In every rural community and in many small towns and suburbs septic tanks are a necessity. And inasmuch as the precast concrete septic tank is by all odds the most convenient and generally satisfactory one available, products makers who are properly situated can generally enter into the manufacture of septic tanks with distinct advantage.

Many things are today working in favor of the septic tank manufacturer. The laws against pollution of streams which are rapidly coming into force as the result of the agitation of the Izaak Walton League and similar organizations, the rapid spread of modern plumbing, and the natural dislike which the plumber has for building a septic tank on the job, all play into the hands of the man who makes concrete tanks.

The things which the prospective septic tank manufacturer would do well to investigate are included in the following:

1. The number of houses being built in the sales area annually that are isolated from any modern sewerage system.

2. The number of the existing houses that are isolated from any sewerage system.

3. The extent to which septic tanks of any type are being used in the territory.

4. The nature of the health laws of the district affecting sewage disposal.

5. The amount of business being done by plumbers in the community.

These various items of information will enable the manufacturer to decide quite definitely as to the possibility of selling septic tanks successfully in his own community. The idea of getting all the information available from the local plumbers is particularly worthy of emphasis.

Pipe and Drain Tile

The manufacture of concrete pipe divides itself into two distinct divisions—the small pipe without bell ends, ordinarily known as drain tile, and sewer or culvert pipe. Concrete drain tile are a very suitable addition to the line of almost any concrete block maker.

The important things to consider before engaging in the manufacture of drain tile are as follows:

1. Whether or not there is any law in force which would affect the use of concrete pipe for drainage purposes or for sewers.

2. The price at which concrete pipe can be supplied as compared with the price at which clay pipe is being sold.

If there is no law to obstruct, and if concrete can undersell clay pipe, it will be found that enough business is usually available to make it well worth while.

There is a large market for the smaller concrete pipe of the 4-, 6- and 8-inch sizes for house connections, etc. It is very easy to sell and deliver them right along with the concrete block for a foundation, or they can be stocked with dealers. Once their use is started, they constitute a considerable volume of business. In most cities, practically all this business now goes to clay pipe.

Another use for 4-inch and 6-inch concrete drain tile which may provide a confortable market of itself is farm drainage. Wherever clay tile are used for draining wet land, or for protecting a house foundation from excessive moisture, concrete tile can just as easily be used. All that is needed to judge the size of this market for concrete tile is the amount of clay tile sold for the purpose. Undersell the clay with concrete, and it will be a pretty poor salesman who will not capture his share of the market.

The manufacture of large sewer or culvert pipe is not engaged in ordinarily as a specialty. Some block makers also manufacture such pipe but, when they do, it is rather as a business entirely separate from their block business than as an adjunct to it. So many considerations, political as well as economic, are involved in the success of this business that it would hardly be wise to attempt to lay down any rules by which the possibilities of success might be forecast. The problem involved is more highly individual than in the case of any other specialty which has been discussed, and the capital needed is also rather considerable. Properly managed, however, the manufacture of sewer and culvert pipe is a profitable branch of the concrete products industry.

Final Considerations

In this brief survey an attempt has been made to point out only some of the most important things to be considered before entering into the manufacture of any one of a number of concrete specialties. Once it is decided to add a specialty, however, there are still a few things that should be remembered in order to make a success of the attempt.

1. Whatever the product that is to be manufactured, be sure that the method of manufacturing it is such as to produce a first class product. See to it that it is as good or better than anyone else's.

2. Set a price on the product that is fair to both the customers and the manufacturer, and then stick to it.

3. Sell the product with the kind of a guarantee you would like to get if you were buying it.

4. And remember, *sell* the product—don't wait for charitable folks to come and buy it.

If the product to be manufactured is selected with proper care, and these principles in making and selling it are adhered to, it will be difficult to fail to make money in the process.

Civil Engineers Discuss Highway Problems

Problems connected with highways, water supply and stream pollution were the major topics at the spring meeting of the American Society of Civil Engineers, held in Asheville, North Carolina, April 20th to 22nd.

The meeting opened on Wednesday, April 20th, with a half-day session devoted to papers on water supply and stream pollution. A paper on pollution of streams by industrial wastes was delivered by Robert S. Weston, consulting engineer of Boston, Mass., followed by George W. Fuller, consulting engineer of New York City, with a paper on the quantity and quality of impounded waters.

On the following forenoon were held simultaneous meetings on construction, power and sanitary engineering topics.

The meeting closed on Friday, April 22nd, with a half-day session devoted to the general subject of highways. The foundations and drainage of highways were treated in a paper by A. C. Rose, Associate Highway Engineer of the U. S. Bureau of Public Roads, followed by a paper on the design, construction and advantages of concrete highways, presented by Clifford Older of Chicago.

Map of Concrete

American boys studying near Paris, France, are constructing a huge map of concrete, with realistic rivers, mountains, volcanoes and other features. The map is accurately made to scale.

EDITORIALS

Building Codes

AT the meeting of the Building Officials' Conference, reported on other pages in this issue, the subject of building codes occupied a considerable share of the time. These men, responsible for the quality of construction in the buildings of their communities are bending every effort to straighten out the tangle created by the hit and miss building codes of today.

The building codes of the future, they believe, will not be written for single cities, but for large areas. And why shouldn't they be? A reinforced concrete column, made according to good practice, will carry the same load in San Francisco that it will in Boston, or anywhere else. Yet the building codes of various cities differ very materially on this and other provisions.

As a reaction against these conditions, building officials are developing model codes which the cities in the territory may adopt. The Pacific coast building code and the Hoover code are illustrations of this tendency. Already a number of cities have adopted these codes, which are prepared to meet modern conditions and to give all building materials a fair break.

These codes fix the general requirements so that they are the same for all cities, but will allow local authorities to insert such provisions as have a peculiar bearing on the particular community.

The question of building codes is one that is of vital importance to every concretor whether he is a contractor or a products manufacturer. On it depends in a large measure his chances for success. It is the city's building code that determines the extent of his probable market and even dictates the kind of a unit he will make. It is the determining factor in many cases of the possibility of using reinforced concrete in structures.

The concretor should work in close harmony with the building officials of the cities in which he operates. He should, individually and through his organizations, work with building officials in getting modern codes adopted. By such efforts he can help his own interests and further the cause of better, safer construction.

The work of the Building Officials' Conference merits not only the approval, but the active support of the concretor.

Secrecy

LAST February at the convention of the American Concrete Institute, Robert F. Havlik of Aurora, Ill., gave a practical demonstration of the "shop secrets" that he has developed in the course of his long experience as a manufacturer of trim stone and ornamental concrete.

An alert concretor, after listening to Mr. Havlik and seeing his demonstration, would have been pretty well equipped to work out Mr. Havlik's methods in his own shop with reasonable success.

More of this sort of thing is needed, and needed badly, by the entire concrete products industry. This is particularly true of the manufacture of ornamental concrete, trim stone and other special branches of the industry. Mr. Havlik does not seem to have lessened his own success by his frankness, and we cannot easily bring ourselves to believe that other specialty manufacturers would suffer by following his example.

If, during the past ten years, there had been a full and free exchange of experiences and practices among specialty manufacturers, we are inclined to think that the industry as a whole would be much further advanced today than it actually is. And we don't believe that the man who is doing an exceptionally good job would be any worse off with competent competitors than with incompetent competitors who discredit both good and bad products in the eyes of the public.

Quality of Coarse Aggregate

SO long as the concrete is workable and the aggregates are made up of clean and durable particles, the characteristics of the coarse aggregate used have less effect on the quality of concrete than is ordinarily supposed.

Good concrete can be made from aggregates that are often considered inferior provided grading of the aggregate, mix, consistency, etc., are taken into account properly. This important fact has been obscured in many investigations because the search for other information has been considered more important.

Tests carried out by a number of different investigators have shown that if the consistency of the concrete and the grading of the aggregates are kept constant, concrete of approximately the same strength and resistance to wear can be obtained with the coarse aggregates having a wide range of qualities. It was shown that approximately the same average strengths and depths of wear were obtained from pebbles, limestone, granite, trap, sandstone, blast furnace slag, flint and marble.

These results are in accordance with the water-ratio theory of concrete mixtures—that the strength of the concrete depends on the ratio of volume of mixing water to volume of cement so long as the aggregates are structurally sound and clean.

A Pipe Plant and a Block Plant Combined

How the Midwest Concrete Pipe Company Makes Concrete Pipe, Block, Manhole Block, and Other Products in Its New Franklin Park, Ill., Plant—Two Plants, One for Pipe and One for Other Products, Work Together—Water-Cement Ratio and Fineness Modulus Control the Mix

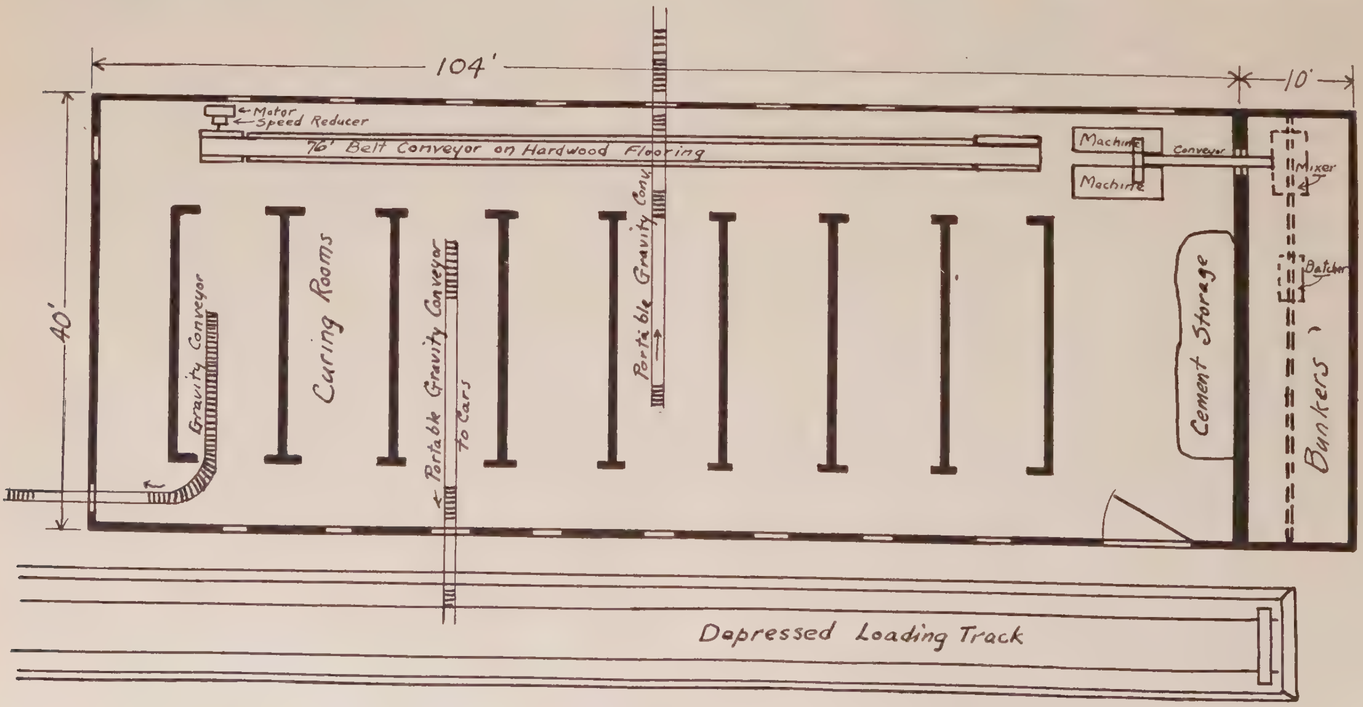
Part I

THE most modern methods of production and of the control of the quality of the products are to be observed in both the pipe plant and the block plant now operated by the Midwest Concrete Pipe Company, in a suburb of Chicago. The firm claims a high grade product produced at a reasonable cost by means of the plant adopted. The block manufacturer will be particularly interested in the fact that block are here carried to the kiln by means of a belt conveyor, and are further handled by means of portable gravity roller conveyors. Then, too, there are a number of other interesting points, such as rail transportation, material handling, routing of the product, kiln design, and so on, to be seen. These plants are of the type operated successfully for some years by an official of the company on the West Coast—The Editors.

THE Midwest Concrete Pipe Company makes concrete pipe, block, manhole block, well curbing, and other products in its new plant at Franklin Park, Illinois. In reality they have not one, but two plants there in Franklin Park. One is devoted to the production of pipe alone, while the other plant just next door is given over to the production of the other units. The plants are well located for the receipt of materials and for the transmission of the products to the user. The site comprises a seven acre tract of land, which is part of an extensive subdivision twelve miles from Chicago's Loop, that is just now undergoing initial development. It is bounded on the north by a main highway (Grand Ave.), on the east by the Minneapolis, Saint Paul and Sault Ste. Marie Railroad, and on the west by the Indiana Harbor Belt Railroad. Thus both truck and rail shipments are readily handled.

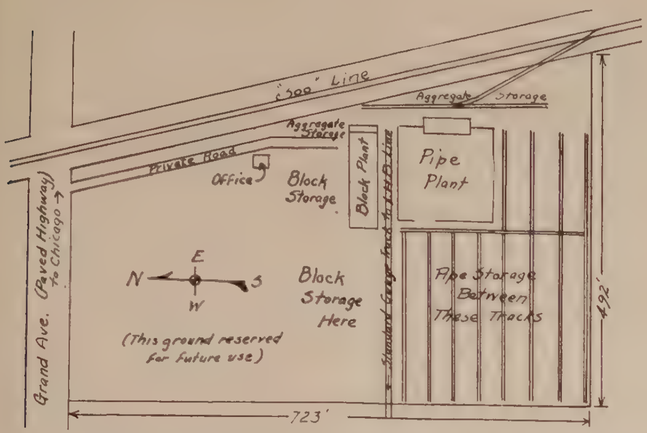
Rail Facilities

The plants are located near the Soo Line tracks in order that materials may be delivered over that line, and the work is routed through each plant toward the belt line, the products finally moving out on that road by means of spurs built into the company's property. Truck delivery is by means of the concrete highway, with a private road built from it to the plant. A glance at the general layout



Plan and section of the pipe plant, showing the location of all equipment shown in one of the drawings will indicate the simplicity of this arrangement.

The company has installed a siding from the Soo Line tracks and running along the rear of both plants for the unloading of aggregates and cement. Material cars are run down onto the siding, and aggregates are unloaded into the storage bunkers by means of a Moore Speed Crane, while cement is unloaded by hand. In that way both plants are kept supplied with the raw materials required.


"Soo" Line
Aggregate Storage
Aggregate Storage
Private Road
Office
Block Storage
Block Plant
Standard Gauge Track to I.H.B. Line
Pipe Plant
Grand Ave. (Paved Highway) to Chicago →
E
N
S
W
Block Storage Here
(This ground reserved for future use)
Pipe Storage Between These Tracks
492'
723'

General layout of the property, with location of the buildings and the stockpiles with reference to transportation

Ready to tamp the bell, with the ring about to be let into place

The Pipe Plant

The pipe plant is a structure 126 feet wide and 130 feet long. Built half into the center of the east wall is a timber bunker, or bin, to hold the aggregates as they are delivered by rail. This bin, loaded by the crane which is equipped with a clamshell bucket, is 40 feet long, ten feet wide, and is 16 feet high. It is divided into two compartments, one for sand and the other for gravel. Directly under this bin, near the center, and on the ground floor, is a No. 3 Universal crusher. While the torpedo sand is conveyed directly to the secondary bunkers inside the building, the 1½ inch gravel must first pass through this crusher for reduction to ¾ inch down to dust. A Weller bucket elevator then takes the discharge of the crusher up to the top of a secondary set of bunkers, into which the material is deposited after it has passed through a revolving screen. This screen separates the crushed material into ¾ inch, ½ inch, ¼ inch material and dust. Each size discharges directly into the compartment of the bin to which it has been assigned. The bunker, divided into a number of compartments, into which this material has been placed, is elevated above the floor, and has an overall length of 30 feet and a width of 9 feet. Each compartment is gated on the bottom. Suspended on overhead rails on the underside of the bunker and continuing the width of a building, is a special proportioning device that measures the desired amounts of the different gradings of aggregate according to production requirements, and holds just enough material for one batch. Material is withdrawn from the various compartments of the bin into this batcher until a combined aggregate of just the right fineness modulus is obtained. The batcher is then pushed along the rails until it is directly above one of the mixers. The bottom is then opened, and the charge allowed to fall into the mixer. When proportioning a batch for wet mix pipe, this batcher discharges into the loading skip of the mixer which lifts the material to the elevated mixer.

Mixing the Concrete

The mixers serving the dry process pipe machines are lined up on the floor in back of their machines. These mixers, which were made by the Tuerck-MacKenzie Company, of Portland, Ore., the same firm that made the measuring device and the pipe machines, prepare the batch and deliver it to the machine by means of a drag chain elevator. The pipe machines rest on the working floor. There are two of them for making dry-tamp pipe, and one for making wet-mix pipe. These machines are of the Bullen type, and are here seen for the first time east of the Rockies. For some years they have been used in a number of plants in the west with considerable success.

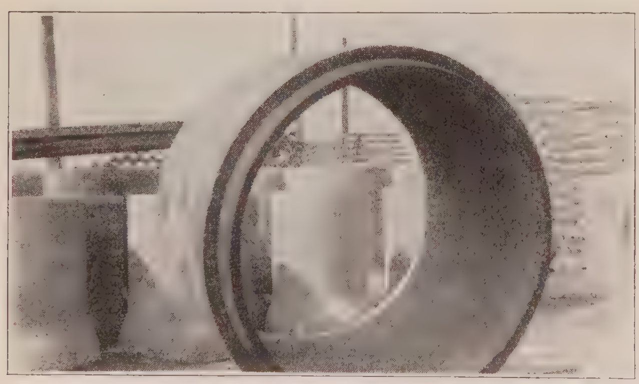
The molds are stripped in the kiln by two men. This shows the old style pallet formerly used, but now discarded for a more improved model

The machine for wet mix pipe is fed by a Wonder tilting mixer, 7-E, equipped with water tank, skip power loader, and chute discharge. The mixer is mounted on an elevated platform in order that it can discharge directly into the pipe mold. The mold is continually jolted by the machine during the casting of the pipe.

The Pipe Machines

The dry-mix Bullen machines are electrically operated, and are controlled by a Cutler-Hammer device. Two motors are required, one to operate the tamping bar and one to operate the rest of the machine. The mold jacket revolves around a stationary core, giving a smooth troweled finish on the interior surface of the pipe. To operate the machine, the mold jacket is first clamped and put in place. Then one-inch layers of material are dropped into this revolving jacket, while the tamper rises and falls, tightly compacting the material. The bell ring is finally dropped into place in order to form the bell. All this time the product rests on a steel pallet that is equipped with legs. When the pipe is finished, the bell ring is lifted, then the core is stripped upward, further smoothing the interior of the pipe. The mold continues to revolve during this part of the operation. A lift cart is then run up, the mold with the new pipe is picked up and carried to the steam room, and the whole assembly let down on the floor. One machine makes pipe up to 18 inches, while the sizes from 18 inches to 30 inches are made on the larger machine, which is equipped with two tampers.

Here is where the efficiency of the pallet is brought to attention. Instead of the pipe resting on the floor it is found to be raised an inch above the floor. This lets steam circulate around the bottom of the pipe and assures better curing of that end of the unit. This leads to a better product, one that will give less trouble on the job. It also permits a short downward movement of the jacket in stripping, thus cutting off the bottom of the unit to a true and even surface.



A 42-inch pipe in the yard—the largest size ordinarily made

Curing Rooms

The pipe are steamed in the kilns for 48 hours and then removed to the yard. These kilns, of which there are seven for dry-mix pipe and another seven for wet-mix pipe, are equipped with steam lines running lengthwise on each side in a small trough, in which spraying devices throw a fine fog into the chamber every two feet along the pipe. These are so arranged that no moisture directly hits any unit.

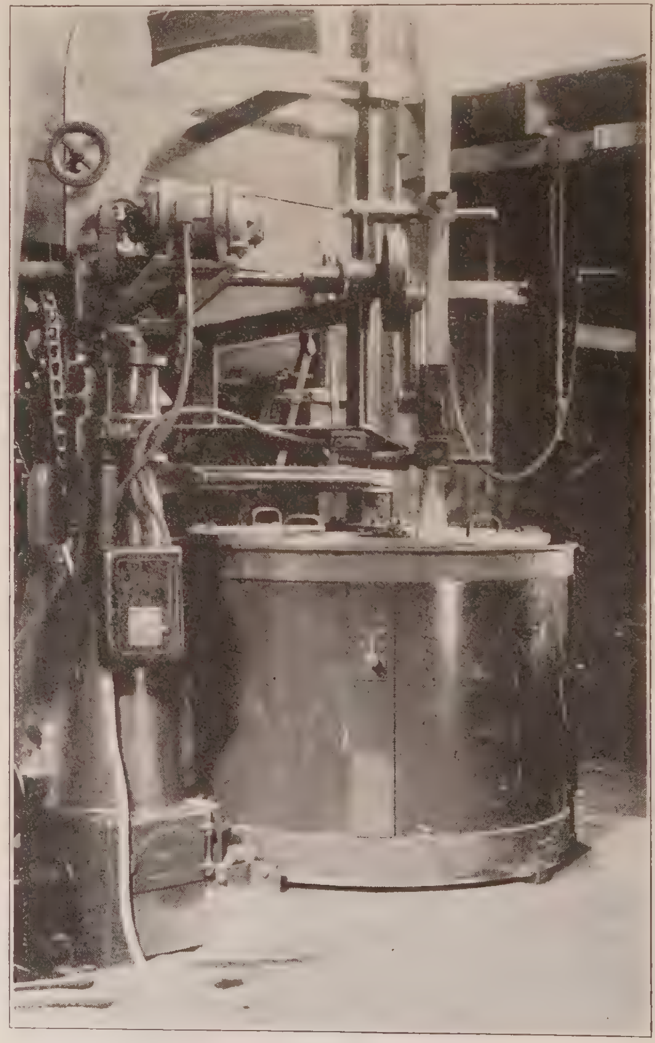
These kilns are designed somewhat differently from those ordinarily seen. They are built with sawtoothed roofs in which are set 9 windows, thereby effectively lighting each kiln. The steep slope of this sawtooth roof is said to eliminate condensed moisture dripping on the products, and allows it to run back to the sidewall and run down into the drainage trough instead. It is the intention of the management to equip the windows with storm sash to reduce heat loss.

The Connection Room

After curing, those pipe which require the addition of connections are removed to one kiln which serves as a connection room. Here a hole is cut in the side of the pipe, and the connection, which has been made by hand, is put in place and secured with a 1:2 mortar. Tests show that this joint is actually stronger than the surrounding pipe. In this department the "Y" and "T" units are made by hand. These special pipe are then cured just as are the others. In this connection work, just as in the other parts of the process, the water content of the mix is watched carefully, and the desired water-cement ratio is maintained accurately for the sake of strength.

Units are unloaded from the kilns by placing them upon small cars that run on tracks set in the kiln floor. A transfer track with transfer car, running at right angles to the kiln tracks just outside the building, allows the transfer of the loaded cars of pipe to any of the yard tracks. These tracks are spaced at 34-foot intervals and run to the extreme limits of the property, permitting convenient storage in any part of the yard. Spurs laid in the yard from the I. H. B. line make it possible to load the units directly into cars for shipment.

(To be concluded)



The pipe is finished. The tamper is striking the final blows at the very top of the units

A Contractor's
Repair Shops and Storage Yards

A Description of the New Repair Shops and Storage Yards of the R. C. Wieboldt Company, General Contractors, Chicago — Repairing Contractors' Equipment — Form Lumber Storage and Fabrication—Replacement Parts—Value of a Central Shop and Yard for Contractors

ALL of the contractor's work is not done out on the job. There are many tasks in connection with equipment maintenance and repair, material supply, etc., that are best done at some centralized point, easily accessible from every part of the city in which the contractor operates. A contractor, like the R. C. Wieboldt Company, who operates 25 concrete mixers, 30 hoists, 250 wheelbarrows, 75 concrete buggies, 500 to 600 feet of chutes, 2000 shores, 40 to 50 power pumps, 4 trucks and 5 trailers, finds such a centralized shop a profitable investment. A storage yard for form lumber in which sizes are sorted and stored for reuse, is also an item in construction costs.

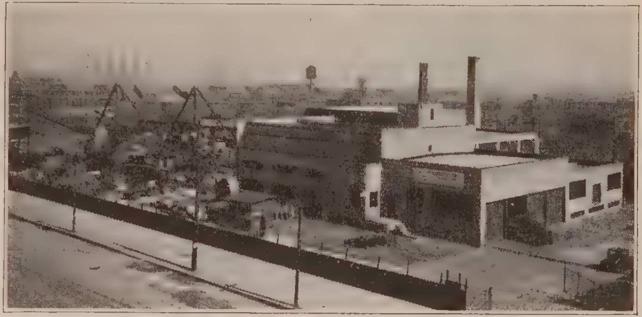
While the plant of the R. C. Wieboldt Company, described in this article, is designed to meet the peculiar condition of that particular contractor's needs, it may provide some suggestions for other concrete contractors.

Location

This new plant is located in Chicago, on Blue Island Avenue, extending from Lincoln Street to Wood Street. The layout, shown in an accompanying illustration, represents one of the most modern and efficient contractor's yards in the country and, while perhaps not the largest, it has gone a long way to solve repair and handling problems. It is distinctly a special purpose plant, designed to fit the various processes, rather than to adapt the processes to the plant.

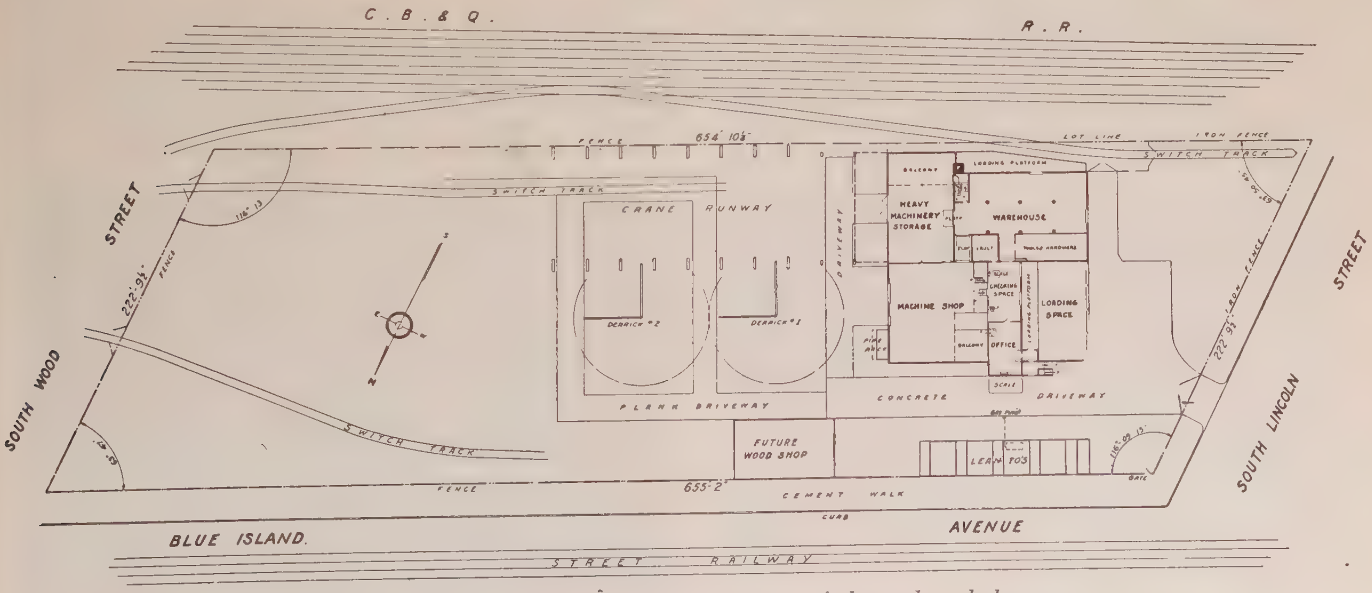
The first move in the selection of a new site was to make a spot map of Chicago showing all available locations within a radius of 4 miles from the center of population. The factors entering into the selection of the site were initial cost, switch track facilities, proximity to main office, transportation facilities within the city, distance from main thoroughfares, advertising value and the possibility of increase in the value of the property.

The piece of ground finally selected contains 131,000 square feet and is served by two switch tracks. It is located about 2 miles from the company's main office, with good transportation facilities, both by street car and elevated.

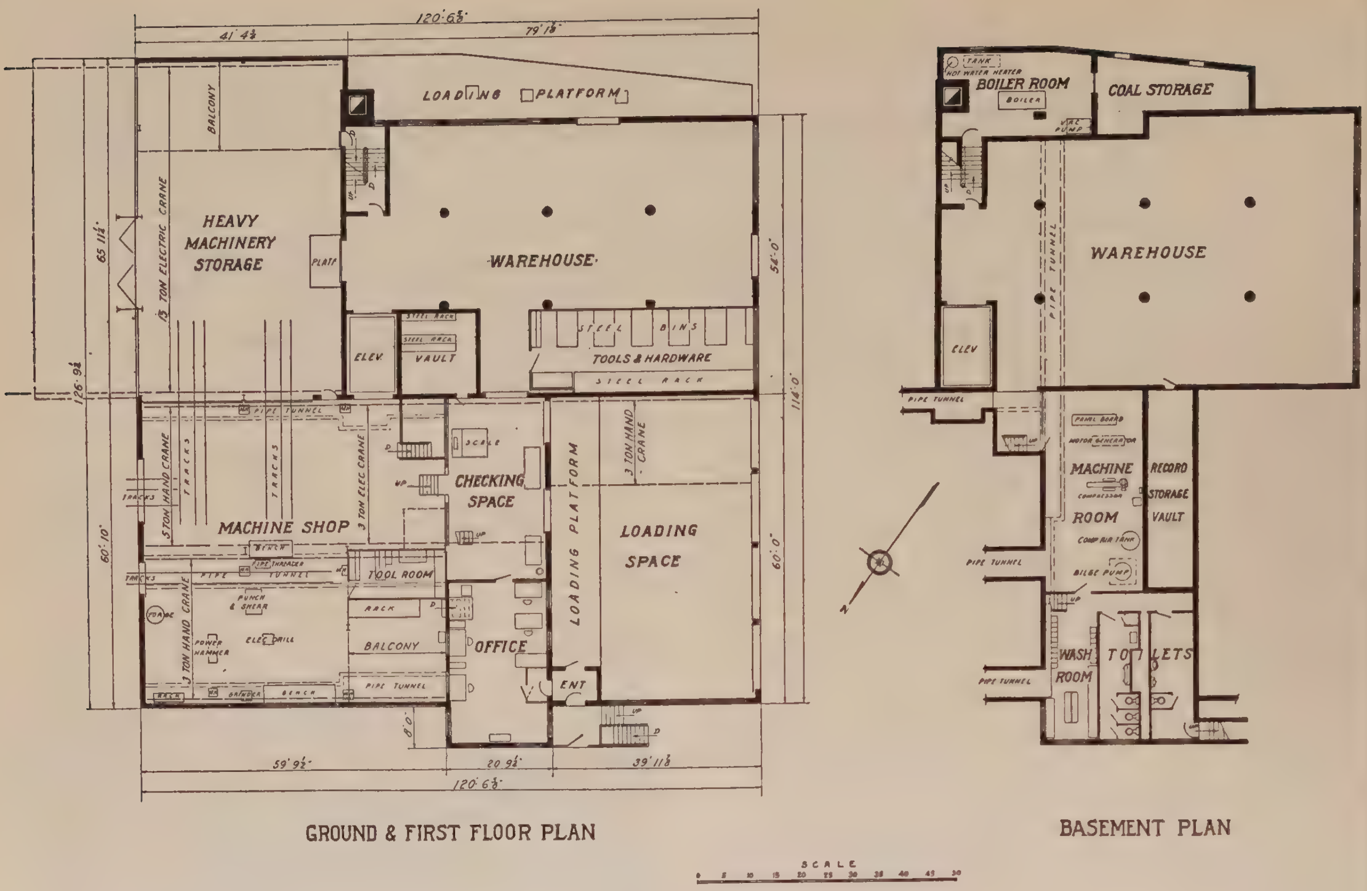

A general view of the plant

General Layout

While the selection of the yard site was being made, plans for the layout of the plant were started. It was decided that the plant include a heavy machinery storage



Layout, showing the location and arrangement of the yards and shops



Floor plan of the buildings showing the various departments

unit, machine shop, warehouse, loading space and platforms and an office, besides wash rooms, toilets, etc.

The decision as to the best arrangement of these units depended on these points: supervision, handling and transfer of equipment from one unit to another, loading facilities for equipment, machinery, tools and supplies in and out and future expansion, both vertically and horizontally. The plant as designed and built provides for future expansion of any unit without interfering with other units. Each department can expand in such a manner that the plant design in general will be adhered to and the larger plant will not be merely a patchwork of units.

The various units were built with certain types of construction, which were primarily determined by usage, although the fire insurance cost was an important factor. They are all fireproof and the insurance cost has been reduced to a minimum. The machinery storage, machine shop, office, and loading space units are built of structural steel. They are one-story, except for the space occupied by the office and sorting space, which has a basement floor underneath. This basement floor is level with the floor of the warehouse unit and contains toilet and wash rooms, machinery room, besides a large storage vault for old plans and office records. The warehouse unit is built of reinforced concrete and contains a basement and first and second floors. The floors are designed for a 200-pound live load.

Equipment

In an attempt to keep operation costs at the new plant down to a minimum and at the same time be able to take care of "peak" loads at the minimum cost, a comprehensive study was made as to the machinery to be installed, which resulted in the installation of the following equipment:

Machinery storage—A 15-ton, 63-ft. span, electric traveling crane, with a 5-ton auxiliary crane for light loads, which covers the entire unit. This crane extends through the end of the machinery storage and runs for a distance of 200 feet over the yard space, so that it serves an area 63 x 240 feet. The area outside is used mostly for storing lumber. With the crane method, the lumber handling costs have been reduced about 80 per cent.

Machine shop—One-half of the machine shop is covered by a 3-ton Conkey electric traveling crane, floor operated, of relatively high speed. In this area most of the repairs to mixers and boilers are made. One mechanic, with the aid of this 3-ton crane, is able to handle a boiler from a hoisting engine or a drum from a concrete mixer unaided, which of course effects a considerable saving in the cost of over-hauling. This crane also extends over the sorting area. By means of an areaway connected to the basement of the warehouse unit, equipment can be

Storage room for heavy machinery

wheeled directly under the crane and lifted from the basement either to the machine shop or sorting space and vice versa.

A 3-ton hand-operated crane covers the other half of the machine shop, so that no machinery or equipment need be moved by hand. This 3-ton crane also covers a mezzanine floor at one end of the machine shop, where electrical apparatus and motors are stored and tested.

There is a landing platform on one side of this mezzanine floor for landing equipment lifted by the 3-ton electric crane. In this way the latter can handle motors directly from the mezzanine floor to the sorting area for shipment on trucks or on cars, as the case may be.

The machine shop where repairs to equipment are made

Loading space—One-half of the area of the loading space is covered by a 3-ton, hand operated crane, which takes machinery and equipment directly from the truck to the loading platform.

Warehouse—The warehouse unit contains a 10,000 pound capacity push button control elevator, with a platform size of 8 x 15 feet. It is large enough to handle any sort of equipment kept in the warehouse unit, besides taking gasoline concrete mixers, pumps, etc., from the machine shop to any of the warehouse floor levels. Material kept in this unit is loaded on push trucks of various sizes and, if necessary, rolled directly to the elevator.

Operation of the Plant

The work performed at the present time at the new plant includes the repair of all machinery and equipment, repair and sharpening of all small tools, manufacture of equipment, such as caisson rings, bull points, hoppers, etc., together with the manufacture of small articles such as stone anchors, miscellaneous pipe work and light structural steel work.

The R. C. Wieboldt Company maintains a staff of service mechanics who are sent out upon call to the various jobs to make whatever field repairs that might be required. Job forces are not permitted to go very far in the repair of equipment as the warehouse can get a man out on the job usually within an hour's time after being notified. A service truck is maintained for taking care of these rush calls and carries a large stock of repair parts, jacks, tools, etc.

The large stock of repair parts which is always kept on hand covering each piece of machinery used eliminates any delay at the yard shop on the repairs of the various pieces of equipment and also permits the field repairs to be made expeditiously. These repair parts are kept in steel racks, all labelled, together with tools and supplies which are used by the mechanics. A large stock of tools, equipment and hardware is kept in the tool and supply room on the first floor of the warehouse unit. All material is kept in steel bins, properly sorted and labelled and in charge of a stock room keeper, who is held responsible for everything therein. This stock is always kept up to date and is probably the most complete stock of its kind around Chicago. A large amount of nails and various sizes of wire is also kept on hand at all times so that the company is not dependent on any outside source for tools, supplies, or equipment.

On the second floor of the warehouse unit a tarpaulin drying and repair room is located. Every tarpaulin brought in from a job is thoroughly dried and gone over carefully so that every tear is mended before it is sent out to another job. They normally keep in use about a thousand tarpaulins.

Replacement parts stock room

Handling Form Lumber

Usually there is on hand at the yard, dependent on the degree of activity, a stock of second hand lumber which has been returned from the various jobs, varying from 500,000 to 1,500,000 feet. This is handled by the 15-ton electric crane.

Lumber is graded, stacked and piled according to the various sizes and is separated into units of about 5,000 feet, so that the crane can pick up a truck or trailer load from the pile and deposit it immediately on the conveyance. A truck can drive under the craneway, receive its load and leave in from three to five minutes.

To further expedite lumber movements, trailers for attachment to trucks are used, on which material is loaded

Every tarpaulin is dried and mended when it is received from the job. The company normally has a thousand tarpaulins on hand

while the truck is out on another trip. Lumber to be returned from the various jobs to the yard is loaded on the trailers and then hauled in. This eliminates truck waiting time and reduces the hauling expense considerably and permits a small yard gang to handle a large volume of business. A small portion of the lumber is piled under two 10-ton electrically operated stiff leg derricks.

There is always a considerable amount of used lumber which is taken in from the various jobs which is not suitable for the average future jobs, such as short 4x4's, 4x6's, 8x8's, etc. A saw mill has already been installed to resaw these pieces into short 2x4's and wedges, which are always readily disposed of. It is self-feeding and contains an inserted tooth saw so that it can be used in lumber containing nails. This saw, which takes care of lumber up to 8 x 8 inches, will handle about 85 per cent of all the material which is to be resawed. The company expects to install another saw for taking care of larger timbers, so that no lumber will be permitted to lay around the yard and rot on account of not being the proper size.

Form lumber storage. As form lumber is returned from the job it is sorted and piled, ready for reuse

Concrete Equipment Storage

Hoppers, concrete buckets, buggies and chutes are stored under one of the 10-ton electric stiff leg derricks, so that none of the machinery, tools and equipment is handled by hand. There is also a provision for a future 10-ton electric traveling crane of 60 ft. span, extending from the end of the machine shop parallel to the present 15-ton crane. The yard space will thus eventually be covered by two cranes and the stiff legged derricks dispensed with. Wheelbarrows, salamanders and like equipment are stored in lean-tos directly north of the concrete driveway. The floors to the learn-tos are built at truck level to facilitate loading and unloading. There are two small hand operated cranes in connection therewith, which permit the easy handling of heavy articles. A limited amount of reinforcing steel is always kept at the yard in order to be able to start a job on short notice. Bar bending equipment is installed to take care of this material.

Value of a Central Plant

With a few notable exceptions, it was found that the problem of the contractor's plant layout had not been given the attention and consideration to which it was entitled. The company was, however, of the firm belief that a yard could be laid out embodying the best arrangement possible, together with modern equipment, repair and handling facilities, which would not only afford a great source of satisfaction, but would also effect such savings, both in the repair and handling of machinery and lumber, as to make it a highly profitable adjunct to its business.

The company plans to erect a modern and up-to-date wood shop for the manufacture of concrete form work in the very near future and so manufacture the forms at the yard rather than at the various jobs. This will be particularly advantageous in connection with large work where there is very little storage room and where a comprehensive woodworking plant cannot be installed. It intends to install other improvements from time to time and thus eliminate a great deal of the work which is now done on the job but which can be performed more advantageously in the yard than at the building site.

Construction of the plant was started about September 1, 1926, and the R. C. Wieboldt Company moved in and started operating it on December 1, 1926. In addition to the construction of the buildings, it was necessary to fill in over the entire area and raise the grade thereof about three feet. The total investment, including land, buildings and equipment, is about $350,000. This, of course, does not include the machinery, tools, supplies and equipment which are kept for use on the different jobs.

All of the drawings for the buildings, including architectural, structural and mechanical, were made by the R. C. Wieboldt Company's engineering department.

Cement Association Opens Montana Office

The Portland Cement Association announces the opening of an office in the Montana National Bank Building, Helena, Montana, in charge of A. L. Strong, District Engineer, who will direct association activities in the state of Montana.

Mr. Strong has been on the district office staff of the association at Yakima and Seattle, Washington, since 1920. Prior to this he had been engaged for ten years in city and county engineering.

How to Make—

Concrete Burial Vaults

Types of Concrete Vaults—Manufacturing Methods—Merchandising Methods—Investment Required—Manufacturing Costs—Profits

THE manufacture of concrete burial vaults is a specialty that deserves the careful consideration of the products manufacturer who is thinking of adding to his line.

It is well to say at the outset that the making of concrete burial vaults demands careful workmanship. It is not a cheap proposition. If the prospective manufacturer expects to succeed, he must be prepared to make a quality product. Because of the unusual demands made of it, only well-made vaults will create public favor for the product.

The profits in concrete burial vaults make their manufacture an attractive venture. But it is not the get-rich-quick proposition some imagine it to be. There is keen competition, not only from fellow concrete vault manufacturers, but from other types of vaults. These conditions mean that aggressive merchandising is a necessity.

Good concrete vaults can be made and sold at profits ranging from $10.00 to $40.00, and in some particularly favorable cases even more, per vault, depending on local conditions. Even if the manufacturer can sell only 2 or 3 vaults per month at the start, this specialty will yield a worth while return.

Types of Concrete Vaults

There are two general types of concrete vault on the market—those on which the cover is sealed after the casket is in the vault and those of the inverted or bell type which are open at the bottom and with which the casket rests on a concrete slab over which the bottomless vault is placed.

There are variations of these principal types. Covers are fastened by different methods such as the visible seal, the invisible seal, etc. Reputable form manufacturers make forms so that any of all the types are available to the prospective vault manufacturer. The names of vault form manufacturers will be supplied to anyone requesting them. It is worth while to get good molds from reputable manufacturers. They last longer and the repair cost, which is an item not to be ignored, is lower.

Manufacturing Methods

The quality of any vault and therefore its reputation, depends on the care and skill with which it is made. When the known requirements for making good concrete are followed the product will be satisfactory.

Aggregates should consist of natural sand or screenings from hard, durable crushed rock or pebbles. What is ordinarily known as torpedo sand has been used with very good results.

As in all other concrete work, the sand must be clean, free from silt or organic matter. It should be well graded from fine to coarse particles with the maximum size not greater than ¼-inch.

Usually a 1:2 proportion is used, though some manufacturers recommend a richer mix. With a 1:2 mix, 2 cubic feet of sand are used with each sack of cement.

It is necessary to mix the concrete fairly wet so that it will fill every part of the mold. The less water used, the stronger the concrete, but the mix must be wet enough to permit proper placing of the concrete.

Forms can be removed in 48 hours, but the vault should not be delivered until 28 days have elapsed. Proper curing is important

The concrete should be mixed by machine. The cement and aggregates are mixed dry until the batch is of a uniform color. Then water is added and the materials mixed for 3 minutes more. It is advisable to mix the required time because adequate mixing increases the strength of the concrete and makes it more workable.

In almost all concrete burial vault manufacture some admixture is used for waterproofing the concrete. In some instances this is added to the mix in the water and in other cases it is incorporated with the aggregates or with the cement. It is necessary to make a truly waterproof vault because one of the important sales arguments for concrete vaults is their ability to remain absolutely dry.

Reinforcement

Varying types of reinforcement are used. In some cases vaults are reinforced entirely with expanded metal or wire fabric while in others steel bars are used in some places. Expanded metal or wire fabric reinforcement should not weigh less than 50 pounds per 100 square feet.

Reinforcement should be carefully formed over a template or by some other method that will make it true to shape and size. It should be carefully placed so that it will be exactly in the middle of each wall or section. This will provide an equal amount of concrete protection on both sides of the reinforcement and will prevent corrosion. Conditions such as a vault must withstand make this an important item. When placing reinforcement, the metal handles by which the cover or the vault itself are handled, should be put in position. They should be firmly embedded in the concrete.

Making concrete vaults. Cages of reinforcement are hung from the ceiling

It is advisable to place 4 lugs in the floor of the vault on which the casket can rest. These lugs also facilitate the withdrawal of the straps when the casket is lowered.

Placing and Curing the Concrete

The molds for the body of the vault are placed bottom upward on a platform. An overhead monorail system together with a chain block permit easy handling of the vault forms.

When the forms are assembled and the reinforcement placed in position, the vault forms can be taken directly under the mixer by means of the monorail system, filled with concrete and placed aside from curing, or the concrete can be taken to the molds it is to fill.

The concrete must be carefully placed into the forms and thoroughly spaded or vibrated. The appearance of the surface is one important reason for exercising care in placing the concrete. Another is the need for a dense water-tight concrete.

After the concrete is placed, the vaults and covers are carried by means of the monorail system to the curing rooms. If steam curing is used, the forms may be removed in 24 hours. If the vaults are cured in the air, a place should be selected where they can be protected from draughts of air and from all exposure that would cause the concrete to dry out too rapidly. Under these conditions, the forms should never be removed until 48 hours have elapsed.

It is necessary that the vaults be removed as soon as practicable. Concrete contracts as it hardens and if the vault shrinks in the iron mold, cracks are likely to result. One successful manufacturer says that vaults that are steam cured should never be left in the forms longer than 24 hours.

After the vaults are removed from the forms, they should be kept wet by sprinkling for a period of 6 days. They can then be stored in racks until used. Never let a vault go to the cemetery until it is 28 days old.

Painting

Practice varies in the matter of painting vaults. Some manufacturers paint the bottom and sides of the vault with two coats of tar. This gives the outside a smooth, black surface and increases the water resistant qualities. The interior of the vault and the cover are then painted with a white waterproofing paint. Other manufacturers use a mixture of white cement and lime for painting the entire vault and cover.

Merchandising

It is generally accepted that the undertaker is the proper man through whom vaults should be marketed. The prevailing practice is to furnish the vault on the undertaker's order and collect the manufacturer's price from him. He, in turn, collects from his client. All he has to do is to call the manufacturer and specify the size wanted. The manufacturer delivers the vault to the cemetery, places it in the grave and seals it after the funeral.

The retail selling price for concrete vaults—that is, the price the undertaker receives—varies considerably with the locality. It ranges all the way from $30.00, where price wars are on, to $125.00. Costs also vary with the size of the vault. A good average price is $35.00 for the smallest size to $85.00 for the largest.

Of this sum, the undertaker receives as his commission from 25 to 50 per cent of the retail price. Sometimes the cemetery also receives a commission for every vault placed. Some manufacturers also appoint the cemeteries in their sales radius as agent.

The principal competition for concrete vaults are steel vaults. The steel vaults are sold aggressively and it requires effort to overcome this competition, even though concrete vaults have greater advantages. In price the steel and concrete vaults are much the same. The commission paid to undertakers for selling them is also much the same.

If the steel vault is already in the territory covered by the prospective manufacturer, he will not only have to sell the idea of using a vault, but he will have to sell the advantages of the *concrete* vault both to the undertaker and to the public.

To do this, it has been shown to be effective to advertise the advantages of the concrete vault in the local newspaper to create a demand for them. When an undertaker has been signed up as an agent, the manufacturer usually gives him a small model vault for demonstration. Form manufacturers will usually lend the products manufacturer the miniature forms for making the models.

Investment Required

When starting in the manufacture of concrete burial vaults, it is advisable to start with at least 2 molds—the so-called 28- and 30-inch sizes. These will cost about $700.00 or $800.00. The vault manufacturer can then rent one of the smaller size molds and make up 8 or 10 child's size vaults to carry in stock.

The 28-inch size vaults are in greatest demand and will constitute two-thirds of the sales.

The possible demand is difficult to estimate. It depends on several factors such as the marketing ability of the manufacturer, the attitude and the buying habits of the public, etc. Usually the death rate is about one per month for every 3,000 of population in the sales area.

Many manufacturers overlook a big potential market when they appeal only to the people in their city. The country market is also very much worth while cultivating. Then, too, there may be a number of towns within truck hauling distance that may furnish an outlet for additional vaults.

The labor and material cost for manufacturing a concrete burial vault is about $11.00 or less, depending on labor conditions. To this cost the manufacturer must add the cost of delivering, placing the vault in the grave and sealing it. With these costs known, he can estimate the profit he can expect.

Before undertaking the manufacture of concrete burial vaults, it is well to make a thorough analysis of the marketing conditions in the sales area to be served. Then, if it appears that there is a prospect of worth while sales, and a quality product is manufactured, there are attractive possibilities for profit in this specialty.

California Sanctions Adoption of Building Regulations by Reference

In the latter part of April, the legislature of California adopted Senate Bill No. 247, which permits cities to adopt regulations governing building construction, plumbing and electric wiring, through the simple procedure of adopting them by reference. The bill has been signed by the governor.

The passage of this law has a special significance at this time because of the approaching completion of the final draft of the proposed uniform building code for Pacific coast cities. Two California cities previously had adopted the tentative draft of the proposed uniform building code by reference, on the basis of decisions of the California Supreme Court in analogous cases. This new law, however, will greatly strengthen the position of cities wishing to adopt the code in this manner instead of going to the expense of printing and giving legal publication to a general building code.

It is expected that after the completion of the final draft of the proposed uniform building code for Pacific coast cities, many of the smaller California cities will take advantage of this opportunity to obtain modern building regulations at a very small cost.

Highway Essay Contest Winners Announced

Winners of the seven awards offered by the American Road Builders Association for best essays on the subject, "Benefits to a Nation by Improved Highways," have been announced by the judges. The first prize of $350 was given to S. A. Lesniewski, a student at DePaul University, Chicago.

The judges included H. G. Shirley, President of the American Road Builders Association and Chairman of the Virginia State Highway Commission; C. R. Ege, past-president of the Highway Industries Exhibitors Association; Thomas H. MacDonald, Chief, United States Bureau of Public Roads; A. M. Braume, Dean of Engineering, University of North Carolina; and Pyke Johnson, National Automobile Chamber of Commerce.

The winners of the second to seventh prizes are John Rex Shepler, Harvard University; Reginald F. Jacobs, Massachusetts Institute of Technology, Boston; Roland Mulhauser, Cleveland; Argus Tresidder, Ithaca, N. Y.; Charles Fitzgerald, Chicago; and H. H. Rogers, Raleigh, N. C.

Plans are tentatively under way for a similar contest to be conducted in connection with the 1928 Road Show and Convention of the American Road Builders to be held in Cleveland, January 9th to 15th, 1928.

Super Cement Now Nationally Available

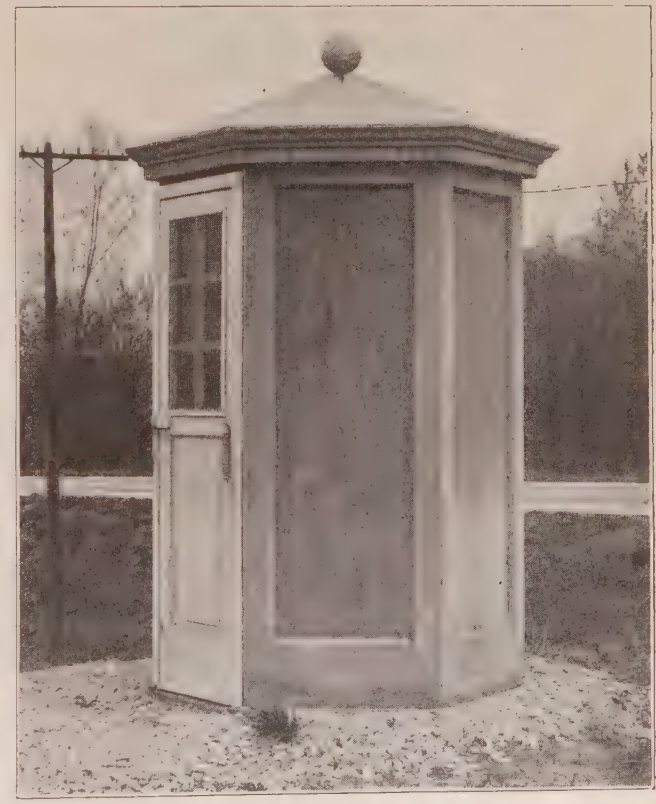
Arrangements recently completed by The Super Cement Company, of Detroit, make Super Cement now available on a practically national basis. It is now manufactured and sold by the Peerless Portland Cement Company with plants at Detroit and Union City, Mich.; the Bessemer Cement Corporation with plants at Walford, Pa., and Buffalo, N. Y., and by the Marquette Cement Manufacturing Company with plants at LaSalle, Ill., and Cape Girardeau, Mo.

"Super Cement" is the copyrighted name of the product made under the patents of the Super Cement Company. The only difference between it and portland cement is the presence of a small amount of catacoll which, it is claimed, develops the potential qualities of the cement itself in greater measure. The addition of this material is claimed to influence the constituents of the clinker to form a hydrate of a more colloidal or glue-like nature than that formed by the union of portland cement and water. This quality, it is claimed, produces higher strengths and greater impermeability to water.

Super Cement has been made in England since 1914, and is now made and sold there by three companies. It was first introduced into the United States from Canada and has been made in this country for some time by the Peerless Portland Cement Company. The other manufacturers listed have recently undertaken its manufacture.

A Concrete Telephone Booth

The concrete telephone booth shown in the illustration is one means through which the Illinois Terminal Railroad Co. cuts down its operating cost to some extent. Excepting the glazed door the booth is entirely of concrete. Cost of painting each year or two and other incidental expenses in repair are being placed in the earnings of the railroad.



Here and There

Some Random Notes on Visits with Concretors in the Field

NATURALLY every man places a lot of value on his own experience. An incident, because it has been a personal experience, becomes very important and it often forms the basis on which the concretor will build his opinions on similar subjects. Personal experience is very valuable, but there is another type of experience that is even more valuable, though it is not always considered so —that is, *group experience.*

Because one concretor, or several for that matter, have made good concrete with a wet mix or with dirty sand, it does not follow that that is the best way to make concrete. Group experience, made up of the accumulation of the experiences and investigations of concretors on hundreds of jobs, shows the fallacy of such contentions. Personal experience must give way in the light of the greater group experience.

It is the purpose of a magazine like CONCRETE to gather the experiences of engineers, contractors, products men and all types of concretors everywhere and to make these available to readers in the form of authoritative group experience.

* *

WE like to think of every issue of our magazine as a convention in which papers are presented on the subjects in which you earn your living. Month after month this convention is called to order—and it meets right in your home or office.

Papers are read and discussed that deal with the problems you are facing. *Your* contribution is needed also, to make all of these meetings interesting and helpful. The pages of your magazine are open for your comments and helpful suggestions. Let us know what subjects you would like to have covered during these monthly conventions.

* *

THERE are several examples of cast stone in London that have been in service for more than 35 years. They have recently been carefully examined and were found to be in excellent condition.

One specimen in London's Limehouse district is 40 years old. It shows no disintegration after such a long time in the sulphurous atmosphere in which it stands.

Some of the cast stone units were installed side by side with natural stone and unless the observer knew that one was cast stone and the other natural stone, he would not be able to distinguish the one from the other.

* *

CONCRETE has entered the realm of politics! In the city of Evanston, Ill., an entire mayoralty campaign was conducted around a street paving issue in which the relative merits of standard concrete and compacted concrete were the bone of contention.

In Chicago, according to newspaper reports, one of the candidates for Mayor assailed the other because he allowed the use of concrete manhole and catch basin blocks during his administration. He was criticized, also, because he used concrete in the construction of the city's sewers.

Oh, well, it is to be expected that when candidates are in the lists, they will cite "concrete" examples to carry their points.

* *

ALMOST every construction job has some interesting feature. Some superintendents are whizzes at form work. In our jaunts we saw a lot of fine stunts that save time and money for the contractor. There was the contractor who used slip forms to such good advantage and the other contractor who worked out a neat stunt on a reinforced concrete building job.

* *

WE have noticed a great interest in specialties among the products makers we have visited during the last few months. It's a healthy sign. Rightly chosen, a good specialty or two can add very appreciably to a products man's annual profits. Of course, not all specialties are profitable in every community, but it is not particularly difficult to avoid the unsalable ones. A little horse sense helps wonderfully in picking the right ones to manufacture, and unless we miss our guess, horse sense is a quality most products men are not lacking.

* *

THE other night, listening to the radio, we heard a hoarse voiced young lady pleading for the privilege of going back to her old home down among the "muddy waters." We are not just sure why, but for some reason her song (or maybe her voice) reminded us of the grumbling we sometimes hear from an old-fashioned mixer boss who is always wishing he was back in the days of what he calls "free water and happy jobs." Maybe he does wish it, but somehow we can't get away from the idea that if he was back in the those days he would be just about as unhappy dishing out the muddy water they called concrete as the tuneful young lady would be if she suddenly found the muddy water she sings about swirling around her ankles and ruining her fair weather shoes.

There's no getting away from it—the good old days ain't what they used to be.

* *

JOE, the Mixer Boss, tells us that he has had a number of very distinguished slump testers join his exclusive organization during the last month. What we haven't been able to get Joe to tell us, however, is whether slump testing is a professional duty, a sacred rite, or an art. We rather suspect that he thinks it is a combination of the latter two. Perhaps this will be determined at his next Conclave of the Cones.

Practical Kinks from the Job

Holding Stirrups for Exterior Members in Place

ONE point in connection with the placing of reinforcing steel in a reinforced concrete building offers unusual opportunities for trouble after the concrete has been placed. This is in connection with the stirrups in exterior beams and girders. The stirrups in the interior beams and girders usually have two wings by which they are hung from the floor forms on either side of the beam or girder, but in the case of exterior members there is of course no floor form on one side and the problem of holding the stirrups in place is a bothersome one.

As a rule the laborer placing the reinforcing solves it by spreading the upper part of the stirrup enough to cause it to bind in the forms as shown at (a) in the illustration. It is assumed that the concrete gang will force the stirrup back from the outside surface of the beam so that there will be a sufficient cover of concrete for the stirrup, but in actual practice this rarely happens and in many newly completed buildings it is possible to determine the location of many of the stirrups as soon as the forms are taken down.

The concrete is then finished up by rubbing with a carborundum stone or a brush coat of cement wash is applied and the building is accepted, only to have the owner find after a couple of years that the moisture has penetrated to the stirrup steel and rust is beginning to show. Such rusting will continue and as the steel in the process of rusting increases its volume very greatly, large pieces of concrete will be spalled off, still further disfiguring the building and enabling the rusting to proceed at an increased rate.

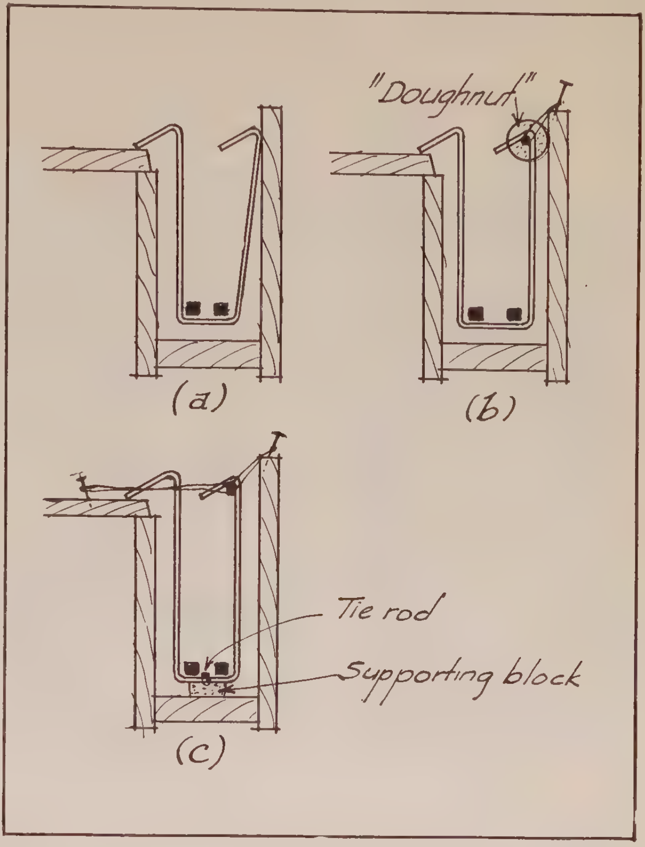
The only satisfactory cure is prevention. Steps must be taken at the time the reinforcing steel is placed to hold the stirrups in a proper position and at a sufficient distance from the face of the beam to prevent the access of moisture.

Two methods are shown. One of these is marked (c) and combines two methods. One method requires that the stirrups be wired to a rod along their soffit before placing. This rod enables them to be supported by means of one or two small blocks of concrete mortar which can be cast for the purpose and set in the bottom of the beam. Another rod is wired to the wing of the stirrups to keep them from falling over.

Or, the rod on the soffit of the stirrups may be omitted together with the supporting block of concrete and the rod wired to the wings of the stirrups suspended from one or more nails driven in the top of the beam side, and the stirrups held away from the beam side by other wires running back to nails driven into the floor forms.

The simplest method, however, is probably that shown in (b) which involves the use of small round "doughnuts" of concrete, threaded on the rod which is wired under the outside wing of the stirrups. A couple of these "doughnuts" will effectually maintain the stirrups at the right distance away from the face of the forms and as the stirrups are all wired to the one rod they can be supported either by placing a small block of concrete under one of the stirrups or by hanging the rod from a nail in the top of the beam side as suggested in sketch (c).

These little "doughnuts" can be made with a light metal cutter somewhat the same as a doughnut cutter, using a cement mortar mixed about 1:2 and with only enough water to make the concrete sticky. The doughnuts can then be cut and placed along on a board or a sheltered piece of floor to harden. The total number required for any job is small and the money spent is certainly justified as there is nothing more certain to give the contractor the reputation for carelessness than inspection of a number of his structures on which the stirrups and column steel are starting to rust through.



A Useful Practice

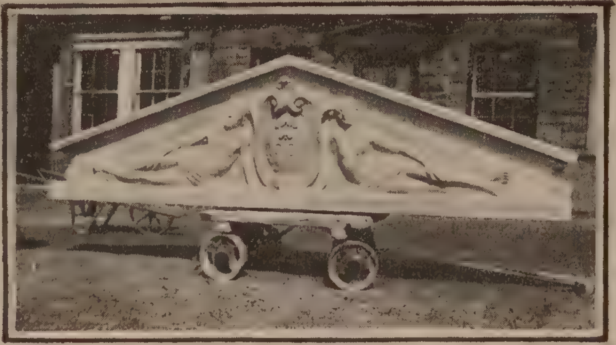
One of the largest construction companies has standardized on a simple "kink" in connection with the removal of floor forms. They string a rope across the direction of the timbers they are lowering. This catches them, and not only breaks their fall, but facilitates the gathering up of the lumber.

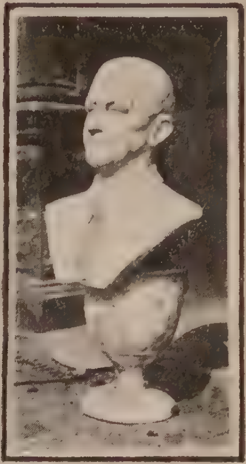
In your work you undoubtedly have run against some problem and have solved it in a simple manner. Pass the idea on to your fellow concretor. Send it in for publication on the Kink Page.

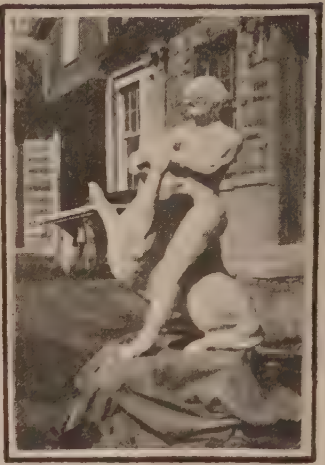
Some Ornamental Concrete

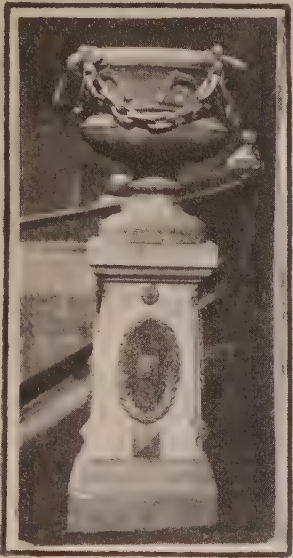
Made by Edward F. Koehler, Bethlehem, Pa.

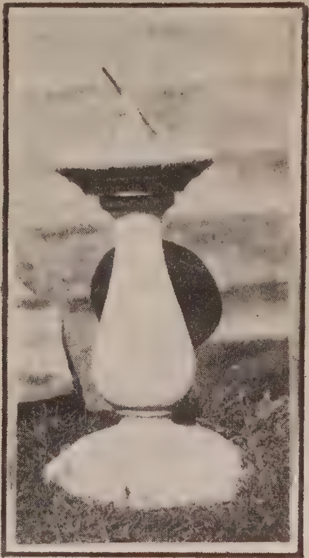
To the right is a bust by Mr. Koehler of himself. Below to the left is a flower pot and pedestal made 27 years ago

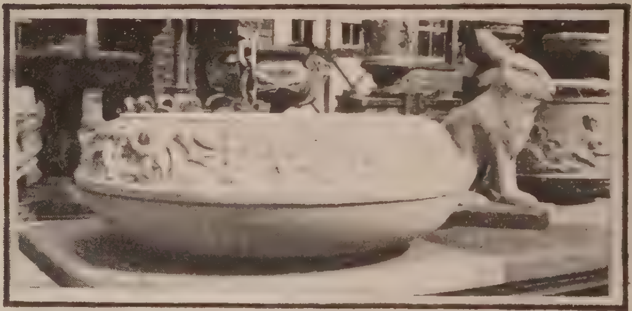


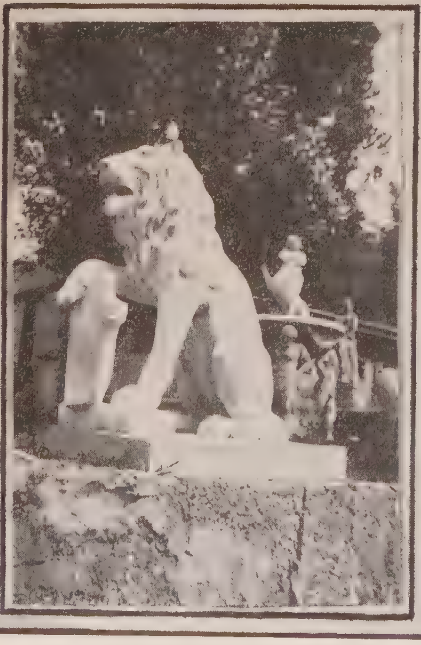


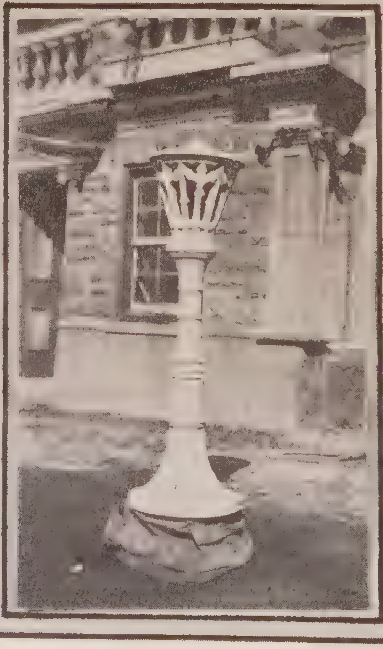


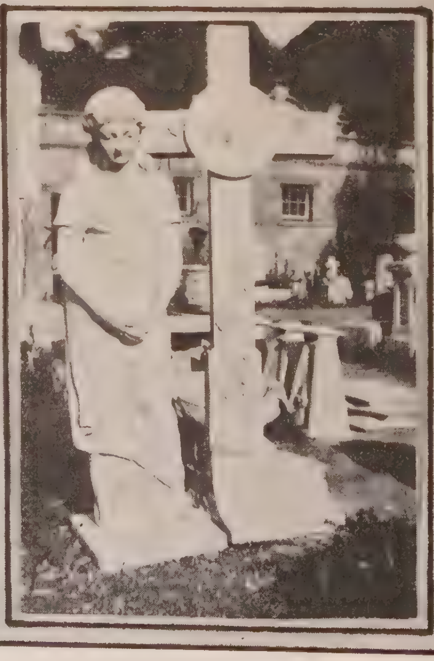












Building Officials' Conference of America Discusses Uses of Concrete

Many Points of Interest to Concretors Discussed—Fire Tests on Concrete Masonry Units—Uniform Building Codes — The Hoover Building Code — Construction Supervision

WITH a registration of about 135 the Building Officials' Conference of America held a series of successful sessions during their Thirteenth Annual Meeting at the Sherman Hotel in Chicago, from April 26 to 29. Many points of interest to concretors were presented in formal papers and in the discussions which followed them.

Concrete Products Laboratory Tests Given Special Mention

A. R. Small, of New York, vice-president of the Underwriters' Laboratories, read an interesting paper on the work of the Laboratories, in the course of which he made special mention of three series of fire and water tests in which hollow concrete units were given favorable fire-resistive classifications. Mr. Small referred to these materials as "substantial and worthy fire retarders which can bear loads under fire." The particular tests to which Mr. Small referred were those on cinder concrete block, reported in 1922 under Retardant Report No. 1429, those on ordinary stone and gravel concrete block and tile, reported in 1924 under Retardant Report No. 1555, and those on "Stone-tile," reported in 1926 under Retardant Report No. 1881.

Visit to Portland Cement Association Laboratory

An interesting diversion during the session of April 27, was a visit to the office building and laboratories of the Portland Cement Association, following which the Association served a buffet luncheon to about 150 guests. Tests prepared in advance of the visit emphasized in visual form the preponderating influence of the water-cement ratio on the strength of concrete.

Uniform Building Code for Pacific Coast Cities

The proposed uniform building code for Pacific Coast cities was under discussion in two papers presented on April 27, one by J. E. Mackie, Secretary of the Pacific Coast Building Officials' Conference, in which the method of procedure followed in preparing the code was outlined. Mr. Mackie confined himself largely to an explanation of the manner in which the preparation and financing of the code was made possible with the limited funds available. The second paper on this subject was a constructive criticism of the proposed code by Frank Burton, formerly building commissioner of Detroit and for two years president of the Building Officials' conference of America. Mr. Burton offered a number of criticisms and suggestions, among which was the statement that combustible construction was permitted in many kinds of occupancy to heights that he considered unsafe. He recommends modification of this feature.

Fire Tests

Wharton Clay, Manager of the Associated Metal Lath Manufacturers, read a paper at the morning session on April 28, on the subject of fire tests. Mr. Clay outlined the history of the principal series of fire tests that dealt with building materials and forms of construction. The general trend of his conclusions was that in many cases unnecessary safety requirements are specified in locations where less severe requirements would be ample.

Florida Hurricane and Its Effects on Buildings

One of the best reports made on the much discussed subject of the Florida hurricane was presented in a talk from notes, by Rudolph P. Miller, who was for many years building commissioner of New York City and for ten years president of the Building Officials' Conference. Mr. Miller investigated the effects of the Florida hurricane on buildings in behalf of a group of fire insurance companies, and also made a special investigation of a type of construction consisting of steel frames covered with metal lath and cement plaster. The gist of his conclusions, and on this point he was very emphatic, was that all the major types of building construction that were properly built withstood the storm.

In cases where concrete block and clay tile buildings failed they almost invariably failed at the joint, the block and tile remaining intact. This, Mr. Miller said, clearly indicated a very poor quality of mortar.

Concerning wind bracing, Mr. Miller suggested that an assumed wind pressure of 30 pounds a square foot on the entire area of buildings will be adequate to resist storms of the intensity of the Florida hurricane. This conclusion was verified during the discussion by Norman M. Stineman, structural engineer for the Portland Cement Association, who stated that in his reports on both the Cuban and Florida hurricanes he recommended the same figure as being ample for the assumed wind load. He said further that the new building code of Miami will probably specify an assumed wind pressure of 25 pounds a square foot up to a height of 125 feet, above which the assumed pressure is to be increased one pound to the story for the next five stories, while from that level upward it is to remain at 30 pounds a square foot.

The Department of Commerce Building Code Committee

The first paper on the afternoon program of April 28, was by George N. Thompson, Technical Secretary of the Department of Commerce Building Code Committee, more commonly referred to as the Hoover Building Code Committee. Mr. Thompson outlined the work thus far completed and under preparation by the Committee. He distributed a complete "key" showing subjects completed, subjects under preparation, and subjects remaining to be covered by reports not yet begun. According to this "key" the work which the Committee has outlined is approaching completion.

From statements made during the discussion it appears probable that the Hoover Committee will not undertake the final drafting of a complete standard building code such as the one under preparation by the Pacific Coast Building Officials' Conference. It is probable that the Committee will confine itself to fundamental reports such as those already printed, covering various subjects and intended to be incorporated into building codes in appropriate chapters.

Better Supervision of Construction

Much of the afternoon session of April 28, was consumed by two papers and discussions involving better methods and better supervision of construction. The first of these papers was by Colonel John W. Oehman, Chief Building Inspector for the District of Columbia. The second was by L. K. Rourke, Building Commissioner of Boston, Mass.

Colonel Oehman's paper dealt with the organization of city building inspection departments; but the part of his paper which drew out the most discussion had reference to the system of inspection introduced in the District of Columbia in July, 1925, when the new building code went into effect.

Under this system owners of buildings utilizing more than 100 tons of structural steel or containing more than 20,000 square feet of reinforced concrete floor area must at their own expense provide special inspectors approved by the building department of the District.

These special inspectors, Colonel Oehman said, are not vested with the complete authority of the District building inspectors, but are required to report to the District building inspection department all deviations from plans and specifications. A special inspector, for instance, is not permitted to issue stop orders; but if he sees workmanship or materials of doubtful quality going into the work he must notify the head of the District building department, who will take such action as may be considered necessary.

The second paper on the subject of better construction, by Mr. Rourke, dealt with the control of building operations in Boston through the licensing of builders. License holders are divided into classes. The nature of the structures coming within the province of each class is fully defined in regulations issued by the Board of Examiners. The holder of a Class "A" license may do any construction work. The holder of a Class "B" license may construct buildings of considerable size, but not those involving complicated organization, etc.

The city of Boston also requires the employment of special inspectors at the owner's expense on certain types of structural work. In many instances, architects or structural engineers must furnish affidavits certifying to the fact that structures built under their supervision have been built in accordance with plans and specifications and that they are structurally safe. Mr. Rourke, however, considers these features as more or less supplemental to the licensing system. He feels that the licensing system itself is the backbone of the high quality of construction obtained in Boston.

Discussion of National Building Code

At the morning session of April 29, considerable discussion arose regarding the feasibility of having the Building Officials' Conference of America undertake the preparation of a proposed uniform building code to be used as a model for city codes. After a lengthy discussion the question finally simmered down to a vote on the preparation of a proposed code containing fundamental requirements only. A majority vote was cast in favor of the proposition and a committee is to be appointed later to study the methods through which such a code might be financed.

Central States Code Considered

A group of delegates representing cities in the Central States region held an informal meeting after one of the regular sessions, at which the subject of a uniform building code for cities in that region was considered. After a lively discussion these delegates resolved themselves into a committee of the whole, with W. C. Muehlstein, Building Engineer of the Industrial Commission of Wisconsin, as chairman. Mr. Muehlstein, who is vice-president of the Building Officials' Conference, will send out a questionnaire to the building inspectors of cities in the Central States, with the view of consolidating their ideas on the subject of a uniform code.

Election of Officers

The election of officers for the next year resulted in the re-election of the present officers, with H. E. Plummer, Building Commissioner of Portland, Ore., as President; W. C. Muehlstein, Building Engineer of the Industrial Commission of Wisconsin as Vice-President; and Fred W. Lumis, Building Commissioner of Springfield, Mass., as Secretary-Treasurer. New members of the Executive Committee, in addition to the three officers just named, include Robert Knight, Deputy Building Commissioner of Chicago; Col. John W. Oehman, Inspector of Buildings, Washington, D. C., and George W. Sherman, Building Commissioner of Worcester, Mass. The hold-over member of the Executive Committee is John Fowler, Building Commissioner, Jacksonville, Fla.

Letters to the Editor

To the Editor:

Due to the wording of certain articles that have appeared recently, I have found some misunderstanding among engineers concerning the recent action of the conference sponsored by the Metals Utilization Committee and their recommendation of one grade of billet reinforcement as a standard for billet grade.

Your article appearing in the April issue of CONCRETE on page 40 is entitled, "Adopt Intermediate Grade of Steel as Single Standard for Reinforcement." This as you can see is somewhat misleading.

If you can consistently do so, I should be pleased to have you call to the attention of your readers, either by another article or in "Letters to the Editor," the fact that the action taken in no way affects the use of rail steel as reinforcement. Our association and its members have been in close touch with the work of Mr. Wetherill's Committee on Metals Utilization and have the complete understanding with that committee that any action taken or reports published concerning this action will include a specification for rail steel reinforcement. Mr. Wetherill and his committee are anxious that no misunderstanding of this recent action be had.

Very truly yours,

RAIL STEEL BAR ASSOCIATION.

(Signed) H. P. BIGLER, *Secretary.*

Modern Types of Building Construction

Some Observations on the Performance of Tall Buildings —Design Lessons Learned from Recent Storms—Effect of Fireproofing on Steel Frames—Preventing Swaying

IN all engineering investigations of the effects of wind storms and other violent disturbances of the past few years one conclusion that stands out prominently is that buildings of the structural frame type are capable of resisting the most destructive wind and earthquake forces within our experience. To be sure, no structure erected by man can withstand the irresistible force of an active volcano; but with respect to earthquakes and violent storms, it is not going too far to say that structural engineers have conquered them.

There is no intention of intimating that all buildings of the bearing-wall type are potential menaces to their occupants. On the contrary, bearing-wall buildings in which the workmanship was a good average and in which common-sense structural details were utilized, withstood even the Florida hurricane of September, 1926. The bearing-wall buildings that failed were those in which the most fundamental structural requirements were disregarded, where roofs and floors were not anchored to walls, where cross-bracing was omitted, and where workmanship in general was of inferior quality.

Structural Framed Buildings

Nevertheless, the excellent performance of buildings of the structural frame type under the stress of several recent natural forces clearly proves that the greater safety is to be found in them. Consider in particular the violent Florida hurricane just mentioned, and one of equal intensity in Cuba a month later, on October 20, 1926. It is not too late to refer back also to the highly destructive tornado that passed over southern Illinois and Indiana on March 18, 1925, for the lessons it taught are no less instructive than those learned from the two great hurricanes. Since no large cities were in the path of the tornado, not many modern buildings were available for study. Nevertheless, the number was considerable, and it is significant that the types of structures that withstood the tornado and the types that failed to withstand it were much the same as in the Florida and the Cuban storms.

The effects of the Illinois-Indiana tornado are fully described and illustrated in a report prepared by a group of structural engineers who made an inspection of the devastated area in behalf of the Western Society of Engineers. The report was published in the Journal of that Society in the issue of September, 1925.

It is true that in the Florida hurricane one tall steel framed building was so badly distorted that it was later demolished to the fourth story, and is to be reconstructed to a height of several stories less than its former height. Two other steel buildings swayed so badly that much damage to exterior panel walls and interior partitions occurred, but the frames did not undergo a permanent distortion. In the region of Miami and Miami Beach these three were the only steel frame buildings that were seriously damaged, while none of the many tall reinforced concrete buildings in that region suffered structural damage.

Fireproofing Structural Steel

Structural designers will see a valuable lesson in the fact that the three steel buildings in Miami which were damaged to the greatest extent were all fireproofed with clay tile units. This is of great importance in view of the splendid showing made by modern tall buildings in Havana during the Cuban storm. All modern buildings in that city have either reinforced concrete structural frames or steel frames encased in concrete.

It is customary, in the structural design of modern steel buildings, to consider the steel frame as taking the entire load, the tile or concrete encasing material being considered only as fireproofing. This assumption holds true where the fireproofing is of tile units, for in each of the three damaged buildings in Miami the tile fireproofing in some places broke away from the steel columns and gave the columns no assistance in resisting the lateral swaying. Where the steel frame is encased in concrete the situation is quite different. Even though the designer may follow the usual practice by considering the concrete only as so much fireproofing material, the concrete actually does relieve the steel frame of much of its load and it adds greatly to the rigidity of the frame. It clings to the steel and therefore helps to resist lateral swaying of the building.

The foregoing is further supported by the fact that in Havana a number of large non-fireproofed steel buildings of the industrial type were destroyed, one four-story steel framed building under construction was destroyed, and the steel frame of a tall office building under construction was slightly damaged. However, no *completed* concrete-encased steel building in Havana was damaged.

The logical conclusion to be drawn from these facts is that the reinforced concrete structural frame and the

The E. H. Gato apartment building in the Vedado district of Havana. A ten-story building of structural steel encased in concrete. It suffered no damage in the Cuban hurricane concrete-encased steel frame are both superior to the steel frame encased in tile units.

Preventing Swaying

The ability to prevent actual swaying of a tall building, so characteristic of the reinforced concrete structural frame and concrete-encased steel frame, is also of immense value in the prevention of damage to non-structural parts of buildings. Referring again to the three tile-encased steel buildings in Miami that were at or near the point of failure, an immense amount of damage occurred to partitions and to exterior panel walls, more especially those running parallel to the direction of the swaying. This is exactly what must be expected, for if the structural frame sways back and forth the panels formed by columns and girders must of necessity become distorted. If this distortion is an appreciable amount, the material within the panels will be shattered. On the other hand, if the panel walls and partitions, as well as the fireproofing around columns and girders, are built of a monolithic material such as concrete, still further lateral rigidity is thereby provided and the structural frame is prevented from swaying.

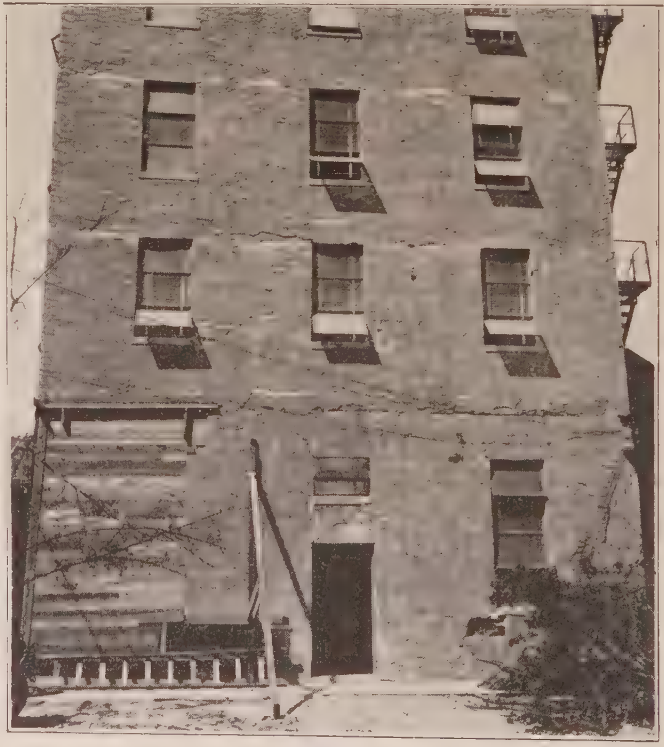
If only a few buildings of the structural frame type had been located in the paths of the Florida and Cuban storms, one might consider that chance or accident played a part. But with so many tall buildings of various structural frame types in both storm regions the lessons taught have a very positive value and the above conclusions are supported by a formidable collection of facts.

The Hotel Astor, Havana. Although this building is very narrow, and the sides are exposed, the reinforced concrete frame prevented damage from the wind

In the Illinois tornado no tall buildings were located in the path of the storm, although several industrial buildings with reinforced concrete structural frames, located in the direct path of the tornado, suffered no structural damage. Windows were blown out and much damage occurred to the contents and to interior partitions. Masonry wall buildings, on the other hand, went down like houses of cards. Among the most distressing failures of this type were several large and supposedly modern school buildings in which a number of children lost their lives.

Robert Clay Hotel, Miami, Fla., one of the many tall reinforced concrete buildings that suffered no structural damage during the hurricane

Without exception these buildings were of so-called ordinary construction, consisting of exterior bearing walls of clay brick and interior wood-joisted construction. The Illinois tornado consequently gives further support to the conclusion that the structural frame type of building is the safest of all types against the action of storms; and after considering all available information, the final conclusion is that the reinforced concrete frame and the concrete-encased steel frame are considerably superior to the steel frame encased in tile units.



The rear wall of the Miami Realty Board Building, after the storm. While the steel frame with clay tile fireproofing did not undergo permanent distortion, it swayed so badly that the walls and partitions were badly cracked

A New Experimental Concrete Highway

California Highway Commission Builds Experimental Concrete Pavement Sections of Varying Design to Study Reinforcing Methods and Transverse Joint Spacing— Pavement Will Be Tested Under Normal Traffic — Twenty-One Different Sections Constructed

A NEW experimental highway, designed to secure data with respect to steel reinforcing and transverse joint spacing, was recently completed by the California Highway Commission. It is expected that the lessons that will be learned from this highway will place it in a class with the Bates Experimental Road, the Pittsburg (Calif.) Test Highway, and other well known experimental pavements.

Unlike these other experimental highways, this one has been built for practical, everyday use on a route that is expected to carry very heavy traffic. It is expected that the effect of the normal traffic will, in a reasonable time, demonstrate which of the sections is the better design for placing reinforcement and transverse joints.

The section built for study is a part of the state highway system, comprising a part of the route between Oxnard and Point Mugu. The road passes through highly productive bean and sugar beet land on an almost direct line. The entire section is on a new location. The flat grades and the almost uniformly sandy subgrade presented an ideal opportunity for the study of pavement design.

Design Features

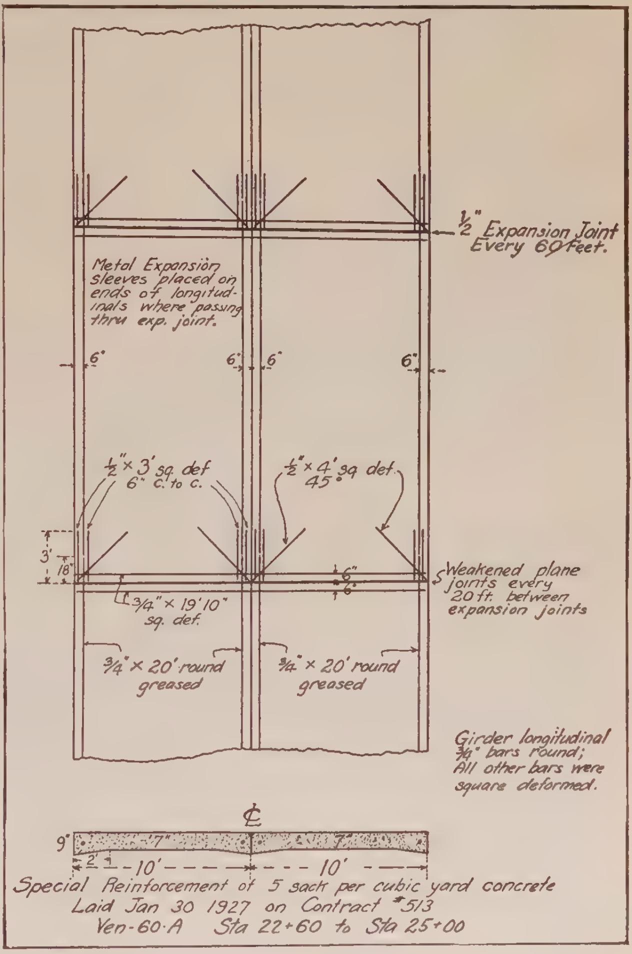
Twenty-one different pavement designs are included. The design changed every 1,200 feet, except for two longer sections at the beginning and end of the project. The various sections were so arranged that any differences in behavior due to possible variations in subgrade or traffic conditions will balance each other when the results for the entire project are considered. Two typical designs, one with mesh or mat reinforcement, the other with bar reinforcement, were placed. Variations of these designs were made for special study.

The concrete used was the standard "Class A" for the California Highway Commission, using 6 sacks of cement to the cubic yard. This mix was used for the entire project except for a short section in which 5 sacks of cement were used per cubic yard. In this section special reinforcement, as shown in Figure 1, was used. The ¾-inch smooth, round longitudinal bars used on this section were greased in an effort to cause them to act as dowels over their entire length. Subsequent comparisons of this section with other sections that contain ¾-inch square deformed bars should determine whether or not the bonding of steel to concrete for transverse or tensile stresses is of as much importance as the dowelling action. This section should also shed some interesting light on the question of providing against corner breaking by placing bars at 45-degree angles.

Poor local drainage decreased the bearing of the subgrade for a stretch of 200 feet in another section. To overcome this condition an additional inch in the thickness of the concrete and additional steel were authorized.

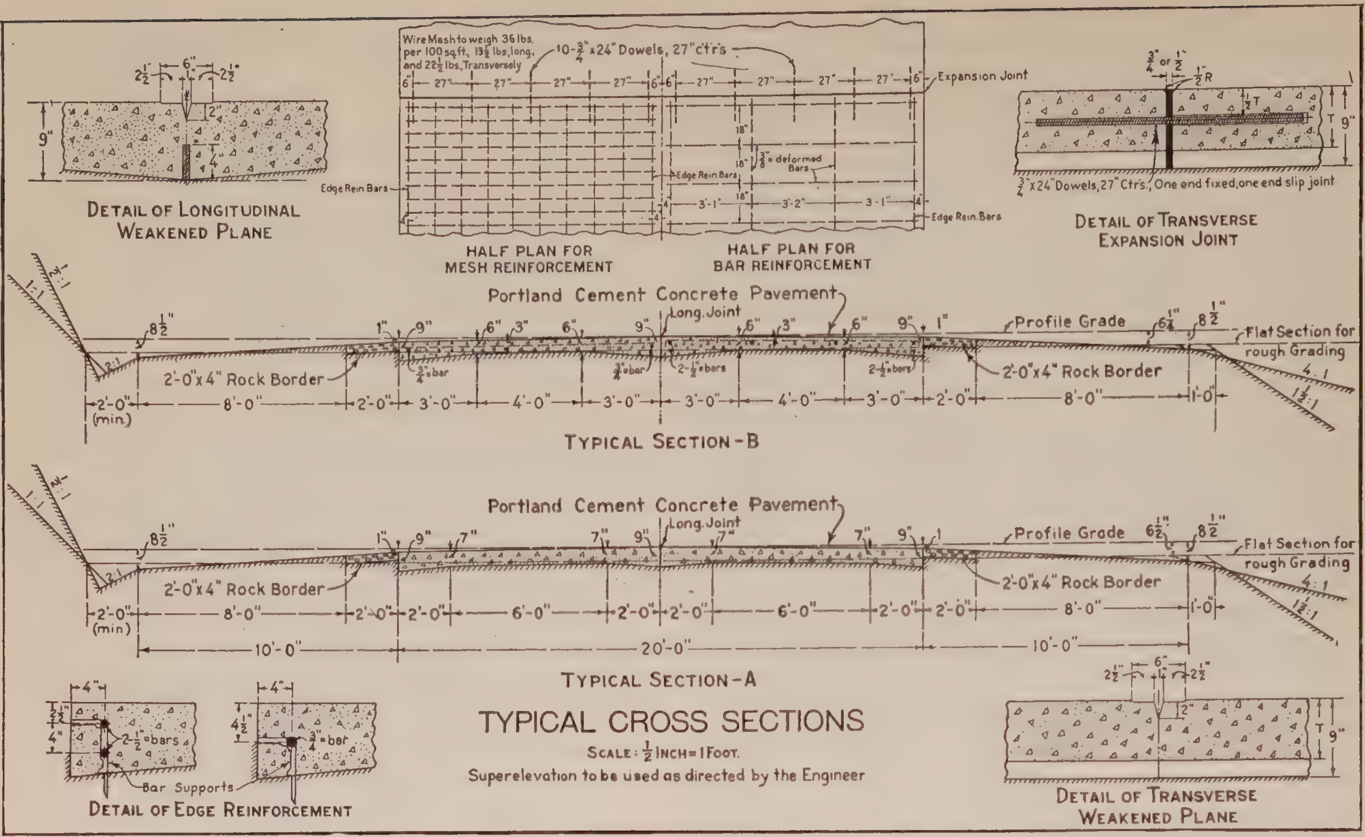
On the three northerly sections, the steel was placed 2 inches from the top instead of 3 inches as originally designed. This change was made because it was thought that by placing the reinforcement near the top, it might be more effective in taking up tensile temperature stresses and the flexural stresses of heavy, concentrated loads. Comparison of these sections with those where the steel was placed in the center of the slab will be of interest.

A short stretch of subgrade was insulated with two applications of asphaltic road oil and in another short section, the contractor was permitted to experiment in the placing of reinforcement. Outside of these variations, no other changes were made from the plans.


½" Expansion Joint Every 60 Feet.
Metal Expansion sleeves placed on ends of longitudinals where passing thru exp. joint.
6"
6"
6"
6"
½"×3' sq. def 6" C. to C.
½"×4' sq. def. 45°
3'
18"
6"
6"
Weakened plane joints every 20 ft. between expansion joints
¾"×19'10" sq. def.
¾"×20' round greased
¾"×20' round greased
Girder longitudinal ¾" bars round; All other bars were square deformed.
℄
9"
7"
7"
2'
10'
10'
Special Reinforcement of 5 sack per cubic yard concrete
Laid Jan 30 1927 on Contract #513
Ven-60-A Sta 22+60 to Sta 25+00

Plan and cross section in which diagonal reinforcement was placed at corners

Each change of section was carefully and plainly marked so that there is no difficulty in identifying the various sections.


Detail of Longitudinal Weakened Plane
2½"
6"
2½"
2"
9"
4"
Edge Rein Bars
Wire Mesh to weigh 36 lbs. per 100 sq. ft., 13½ lbs. long., and 22½ lbs. Transversely
10-¾"x24" Dowels, 27" c'tr's
Expansion Joint
18"
⅜" ▫ deformed Bars
Edge Rein Bars
3'-1"
3'-2"
3'-1"
4"
Edge Rein. Bars
Half Plan for Mesh Reinforcement
Half Plan for Bar Reinforcement
¾" or ½"
½R
½T
T
9"
¾"x24" Dowels, 27" Ctr's., One end fixed, one end slip joint
Detail of Transverse Expansion Joint
Portland Cement Concrete Pavement
Long. Joint
Profile Grade
8½"
6¼"
Flat Section for rough Grading
2'-0"x4" Rock Border
¾" ▫ bar
2-½" ▫ bars
2'-0" (min.)
8'-0"
2'-0"
3'-0"
4'-0"
1'-0"
1½:1
2:1
1:1
4:1
Typical Section-B
6½"
7"
6'-0"
10'-0"
20'-0"
Typical Section-A
TYPICAL CROSS SECTIONS
Scale: ½ Inch = 1 Foot.
Superelevation to be used as directed by the Engineer
4"
4½"
2-½" ▫ bars
¾" ▫ bar
Bar Supports
Detail of Edge Reinforcement
Detail of Transverse Weakened Plane

Typical designs used on the experimental highway

Reinforcement

Three methods of supporting the longitudinal steel bars in the pavement slab were used:

(1) By using ½- by 12-inch steel pins which were driven into the subgrade and to which the longitudinal bars were wired.

(2) Movable braces, an invention of the contractor, which were taken out after the concrete had been spread and which were then reset in a new location.

(3) Stiff No. 8- or 10-gauge wire supports, bent and welded with top bars and hooks. They were driven into the subgrade and into the headers and left permanently in place.

The third method proved to be the most satisfactory. The wire supports made it possible to place the reinforcement well in advance of the concrete. The bars were held firmly in place not only vertically and horizontally, but also longitudinally. This was particularly important because the breaks in the longitudinal reinforcing had to be accurately spaced for weakened plane transverse joints. The wire supports, when left in place, also insured against movement of the reinforcing steel during tamping.

When wire mesh or ⅜-inch square deformed bars were used, the procedure was as follows: A layer of concrete was struck off with a template at the depth to which the reinforcement was to go. The wire mesh sheets or the previously assembled mats of steel bars were then placed and wired in position. The mixers were then moved back and the top layer of concrete was placed, tamped and finished in the usual manner.

Of the various methods tried other than the use of wire supports, the placing of the concrete in layers appeared to give the best results from the standpoint of holding the steel in its proper place.

To guard against corner cracking where longitudinal edge and center bars were specified, the reinforcement was carried transversely across the slab, parallel to all expansion joints. A break in the longitudinal steel was always made at all transverse expansion or weakened plane joints. No steel passed through the joints except the ¾- by 24-inch dowels. These were placed with slip covers on one end to permit movement. Ten dowels were used at each expansion joint and 4 dowels at each of the weakened planes. Dowels were held firmly in place by wiring them to steel pins which were driven into the subgrade. The placing of the dowels was given particular attention because this detail is of primary importance in any study of pavement cracks.

Weakened Plane Joints

Considerable difficulty was experienced in the construction of the transverse weakened plane joints. A cross section illustrating the construction used is shown in Figure 2. It was required that the transverse V-groove on this job be the same as the standard centerline V-groove. An effort to follow this requirement presented difficulties in securing a smooth surface. It seemed that they could not be built without making an objectionable depression.

A method developed on the job was found to overcome this difficulty. Under this plan the V-groove tamper was impressed in the concrete after the heavy longitudinal float had passed. In this groove a ¼- by 1½-inch by 19 foot, 10 inch, steel plate, bent to roadway crown, tapered, and drilled with holes near the top to facilitate pulling, was placed about ¼-inch below the surface of the concrete. Longitudinal floating was then carried on until the pavement over the plate was as smooth as elsewhere. After the concrete had dried out sufficiently, an edger was run along both sides of the plate, giving it the appearance of an expansion joint. After about 4 hours had elapsed the concrete was hard enough for the plate to be pulled and used over again. Great care had to be exercised to keep the plates scrupulously clean and well oiled to prevent breaking off the edges when pulling the plate.

The centerline V-groove under which a submerged wood strip is placed and the dowelled expansion joints as used on this highway, are now standard California practice. The weakened plane transverse joints which afford relief for tensile stresses by localizing contraction cracking, are a new procedure, although a similar idea has been used by the city of Seattle.

Construction Methods

The contractors—the United Concrete Pipe and Construction Company—appreciated the fact that this contract was unique in its variety for exacting requirements. They realized also the disadvantages of the usual methods of hauling concrete paving materials and of conducting mixing operations on a subgrade composed of the prevailing sandy soil. The concrete was placed by two 5-sack mixers, working opposite each other on 10-foot earth shoulders, which were a part of the highway contract. In this manner each paver placed a half of the 20-foot pavement while operating entirely outside the forms.

Pneumatic-tired dump trucks delivered preproportioned batches to the mixers. All traffic was kept entirely off the subgrade, the hauling being done on the earth shoulders. This arrangement made it possible to line up the pavement steel and the transverse joints well in advance of placing the concrete. It also diminished confusion around the mixers and made for better progress. To speed up finishing, the contractor used two Lakewood tampers which worked in conjunction with one another.

When weakened plane joints were being placed, 9 finishers were required to take care of the normal day's run. Adverse weather conditions prevented any record of exceptional progress on the job as a whole, but on many days over 400 cubic yards (more than 900 linear feet) of concrete were placed.

As traffic uses this highway, it is hoped that the experiments made will develop data of importance to many of the present unsolved problems in concrete pavement design.

A Precast Concrete Pipe Conduit

Dayton, Ohio, Installs a Concrete Pipe Conduit, 2½ Miles Long — High Early Strength Concrete Speeds Construction

THE Water Department of the city of Dayton, Ohio, is now constructing an 84-inch concrete conduit to convey water from wells, from which the city's water supply is taken, to the main pumping station, a distance of 2½ miles. The conduit is constructed of precast reinforced concrete pipe, 12½ feet long, patented by I. D. Tramell of Fort Worth, Texas.

The pipe sections are cast in a yard along the line of the new conduit and are hauled to the work on a standard gauge railroad. Pipes are cast vertically, bell end down, in steel forms which fit into a machined cast iron casting forming the bell, another casting being placed on top of the steel forms to form the spigot.

Reinforcement is made up of several different rolled shapes, which are built up and electrically welded into a cage, which is stiff enough to stand up without the slightest sag.

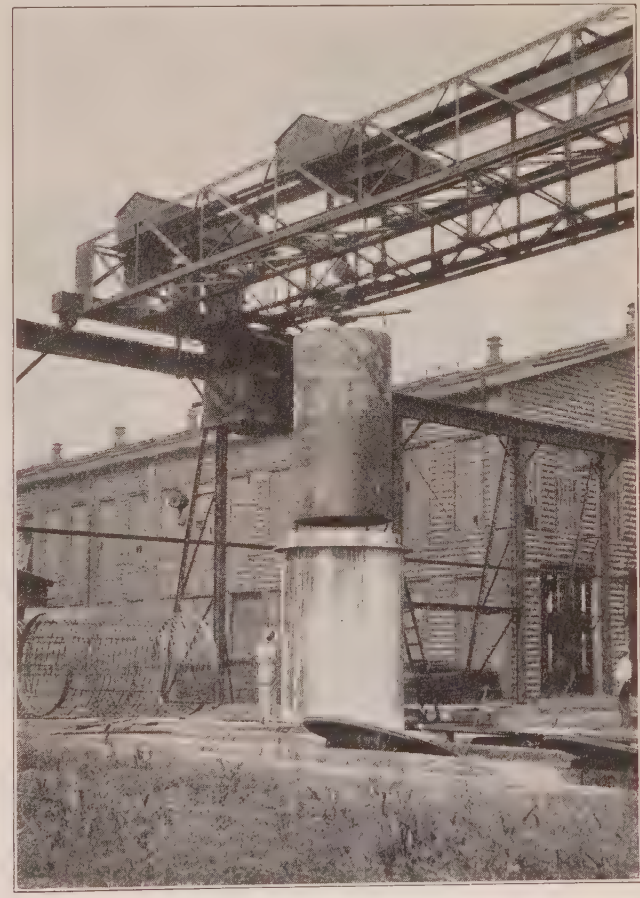
High Early Strengths Secured

The forms are set up and poured, the following day the forms are removed, set up and poured again. The use of a cement giving high early strengths permits the early reuse of the forms.

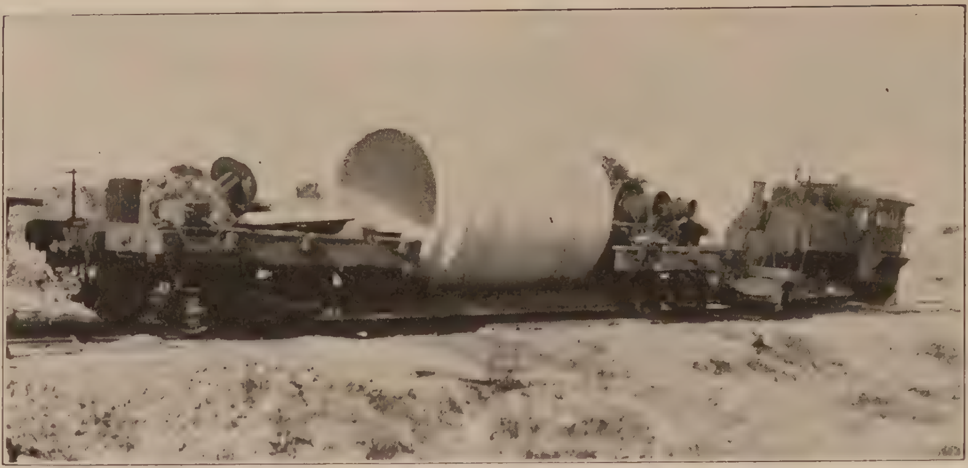
On the fourth day the pipes are picked up by a traveling crane, using a special sling, and laid on their sides on timber skids or rollways. After the sixth day the pipe can be loaded on cars, hauled and placed in the trench. Tests on samples of concrete used show 2900 pounds in 2 days, 3164 pounds in 3 days, and 3684 pounds in 7 days.

Excavation is made by a Wiley Whirley on skids and rollers and a 1-yard dragline bucket. The pipes are unloaded from cars and placed in the trench by a second Whirley. Backfilling will be done by a third one. The pipes are jointed by a poured lead joint.

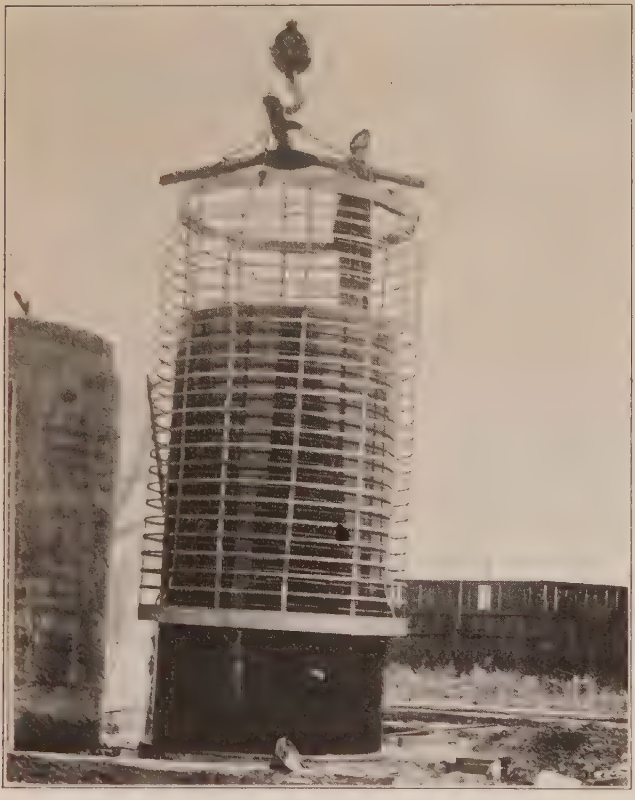
Concrete saddles which are formed to the outside diameter of the pipe support the pipe in the trench. Two of these are placed for each pipe. They are made of a size



Pipes were cast vertically in steel forms which fit into a machined cast iron casting forming the bell



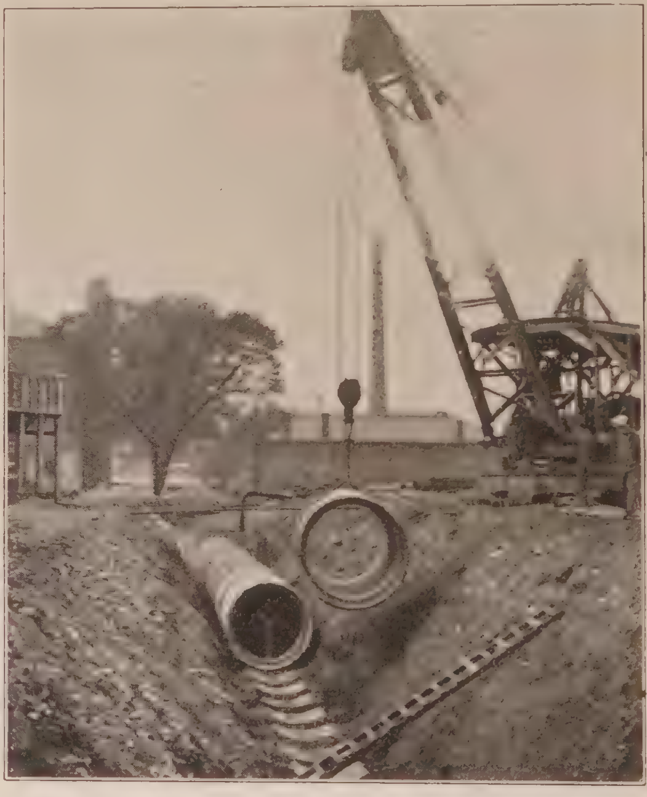
Delivering the pipe to the trench in which it was placed



Reinforcement was made up of rolled shapes, electrically welded into a cage

that provides a bearing area of one ton to a square foot with the pipe full of water. The saddles are constructed ahead of the laying and are left a half-inch low. Pipes are brought to grade by a cushion of dry cement and sand.

The general contract for this work was let to Price Brothers of Dayton, Ohio, who are manufacturing the pipe. The excavation and laying was sublet to the Wiley Construction Company of Dayton. The work is being done under the supervision of the General Superintendent of the Division of Water of the city of Dayton, Ohio.

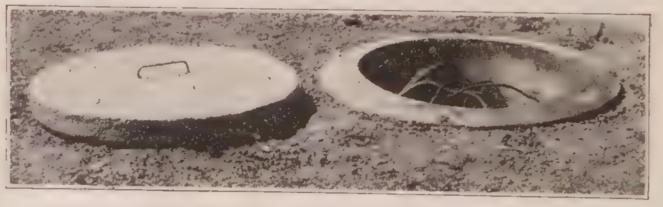


Placing the pipe. It is supported on concrete saddles

Concrete Pipe Enclose Underground Batteries

The Southern California Edison Co. installs storage batteries in sections of concrete pipe placed just below the ground level so that the batteries will be kept cool.

The sections of pipe are placed upright in an excavation prepared for them. After a section of pipe is laid and the conduit for wiring installed a concrete slab is poured in the bottom of the pipe and the battery rests on this. Cast concrete covers are used for enclosing the box.



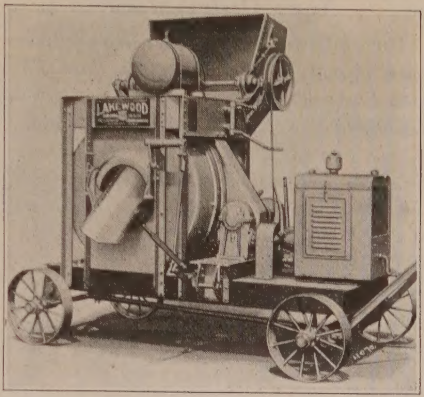
New Equipment

Worm Speed Reduction Mixer in New Size

A size 10-S, A. G. C. rating, mixer has been developed by the Lakewood Engineering Company, Cleveland, Ohio, that embodies some advances in automotive engineering and the use of heat-treated materials. The principal driving mechanism is a heat-treated steel worm mounted on large Gurney ball bearings and direct-connected to either a gasoline engine or electric motor.

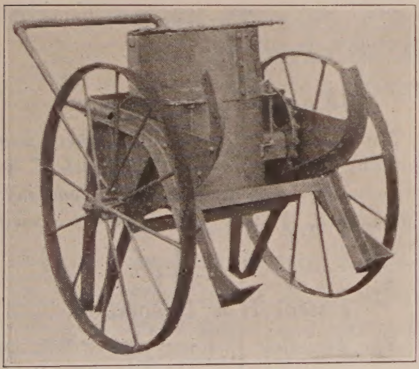
The power loader skip, batch hopper and discharge chute all have a 50-degree discharge angle, for clean, fast charging and discharging.

The pivoted power loader is equipped with automatic knockout and all levers are banked for one-man operation. The use of the worm speed reduction makes all parts of the engine as well as parts of the mixer easily accessible for adjustment. Alemite lubrication is used throughout.



Junior Inundator for Small Wheelbarrow Job

The Junior Inundator has been developed to measure sand and water to automatically proportion for the variable moisture in sand and at the same time automatically eliminate a further variable by compensating for the bulking of moist sand. It requires no change in the rest of the equipment on the job, according to the Blaw-Knox Company, Pittsburg, Pennsylvania.



A New, Efficient Hoisting Elevator

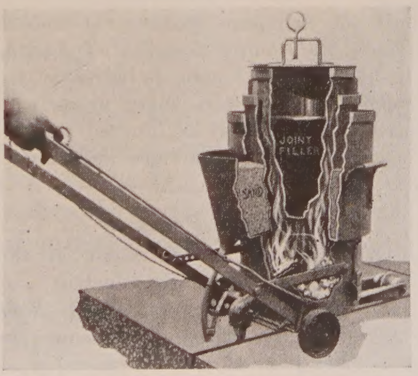
A new addition to contractors' hoisting equipment is made by the O. K. Clutch and Machinery Company, East Columbia, Pa., in its "O. K." portable elevator for hoisting wheelbarrows and concrete buggies. It is particularly advantageous on small building jobs, to replace a hoist tower for elevator or concrete chute. Ten-foot sections may be added as desired.

Joint Pouring Machine Pours 50 Feet Per Minute

A new joint pouring machine has been developed by the Heltzel Steel Form & Iron Company, Warren, Ohio, which heats, pours and sands.

It is so constructed that the fire is between the joint filler compartment and the sand compartment.

The flow of sand and filler is controlled by hand handles which are adjustable as to height. No bridging is necessary and the broad tread wheels do not mar the concrete. A pilot wheel running in the joint insures perfect alignment.

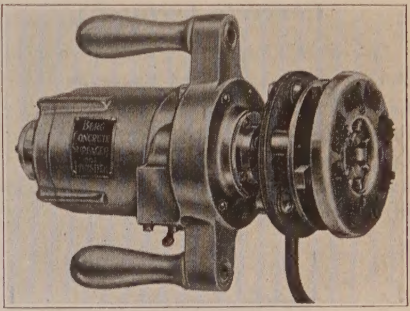


The sanding compartment is recommended for use on grades to prevent the filler from flowing out but is not necessary on semi-level roads.

A fire box is provided for any kind of fuel or is equipped with oil burner when desired.

Reduce Weight of Berg Surfacer

Engineering efforts to improve the "Berg" surfacer and finisher have resulted in an increase in power to the extent of 50 per cent, lighter weight, and a lower cost. The finisher is now made in two models, known as the "Berg Regular," weighing 23 pounds, and the "Berg Universal," weighing twelve pounds. The Concrete Surfacing Machinery Company, Cincinnati, Ohio, manufactures the tool.



"Flud-Oil-D" Lubrication on Novo Pumps

A recent issue of "Novo Power" describes the new Novo Engine Company's "Flud-Oil-D" high-pressure pumps. A small gear—the only moving part—serves to deliver the oil to all parts of the pump. With the correct amount of oil in the pump and an adequate supply of fuel, water and oil in the power unit, the pump will operate in isolated places without attention. "Flud-Oil-D" pumps include the enclosed, one- and two-cylinder double-acting and the enclosed, single-acting triplex high-pressure pumps.

Carr Forms With Four Stake Pockets

The Lakewood Engineering Company, Cleveland, Ohio, manufacturers of the Carr Road Form, announces that this form is now provided with four stake pockets per 12-foot section. The form is locked to the stakes by simple key wedge.

This improved method of staking, together with the other features of the round top, wedge lock joint, and 12-foot section have created much favorable comment from both engineers and contractors.

With the Manufacturers

NOTES FROM THE FIELD

P. T. L. Branch

The Pittsburgh Testing Laboratory has established a branch laboratory and inspection headquarters in Youngstown, Ohio, equipped for all kinds of physical tests of engineering and construction materials. *Mr. H. L. Christman* is in charge.

Concrete Lecturer

Col. H. C. Boyden, lecturer on cement and concrete, has joined the staff of the *Celite Products Company.* A series of lectures is being arranged to be delivered by Col. Boyden before engineering societies and associations and engineering colleges in the United States and Canada.

Smith Distributor

Payne G. West, 2937 East Grand Blvd., Detroit, Mich., has been appointed by the *T. L. Smith Company* of Milwaukee as distributor of *Smith* Mixers and Pavers for the eastern Michigan territory.

Chain Belt Past Year

At the annual stockholders' meeting recently held, 1926 was reported as one of the best years in the history of the *Chain Belt Company,* Milwaukee, Wisconsin, with an increase in sales of about 10 per cent over 1925.

Marsh-Capron Dealers

The appointment of four new dealers is announced by the *Marsh-Capron Company* of Chicago.

The following new dealers will carry in addition to a stock of repair parts, complete, new machines on display ready for immediate delivery.

National Machinery & Equipment Co., 91 Connecticut St., Seattle, Wash.; *Marble, Cement & Coal Co.,* Southern Ave. & Penn R. R., Muskegon, Mich.; *S. M. Caldwell,* 406 Mead Building, Rockford, Ill.; *A. W. Sikking & Co.,* 116 North 6th St., Springfield, Ill.; *R. S. Smilie,* Wells Fargo Building, San Francisco, Calif.; *Burke Machinery Co.,* Porter Building, Portland, Oregon.

The following will carry a stock of repair parts: *Ben Nieboer,* 1011 Sherman Street, Grand Rapids, Michigan, Bashford-*McCord Corp.,* 1346 University Avenue, Rochester, N. Y.

Novo Distributors

The following new distributors have been recently appointed by the *Novo Engine Company:*

Construction Equipment Co., Columbia, S. C., *San Antonio Machine & Supply Co.,* San Antonio, Texas, *H. E. Erickson Company, Inc.,* 114 So. Third St., Minneapolis, Minn.

Rex Representatives

The Milburn Machinery Company, 141 North Front Street, Columbus, Ohio, have been appointed *Rex* mixer and paver distributors in that city by the *Chain Belt Company,* Milwaukee, Wisconsin.

Mixer Distributors

The George B. Curd Equipment Company of 609 Reading Road, Cincinnati, Ohio, has been appointed by the *T. L. Smith Company* of Milwaukee as distributor of *Smith* mixers and pavers for the Cincinnati and Dayton territories.

"Wonder" Sales Manager

Paul Johnson has recently been appointed Sales Manager of the *Construction Machinery Company,* Waterloo, Iowa. Mr. Johnson was formerly connected with the Humphryes Manufacturing Company for a number of years.

INDUSTRIAL LITERATURE

Atlas Booklet

A bulletin published by the *Atlas Portland Cement Company* under the signature of H. Eltinge Breed, highway engineer, deals with high early strength concrete attained with standard portland cement.

Hoist Systems

Some two dozen systems of floor operated electric hoists are catalogued in an illustrated descriptive catalog published by the *Shepard Electric Crane & Hoist Company,* Montour Falls, New York.

Anchor Products

In an eight-page booklet, the *Anchor Concrete Machinery Company* of Adrian, Michigan, makes known the advent of its double-power stripper. Other strippers, a marking device, and an inverted stripper for catch basin block are also described.

"Stacker Practice"

Copies of the annual edition of the *Lewis-Shepard Company's "Jacklift and Stacker Practice"* are now available. Well spent effort was exerted in presenting in this publication a complete assembly of equipment.

Platform Catalog

The Barrett-Cravens Company, Chicago, have just released an attractive catalog, covering their lines of *Steeleg* platforms and featuring special types for unusual applications.

Welding Bulletin

Automatic arc welding to cut the cost of joining steel is the subject of a new *Lincoln Electric Company* 24-page bulletin. The principles and details of this method of welding are explained and illustrated, and the use of *"Stable-Arc"* automatic welding on several types of industrial equipment is shown.

Koehring Speedster

The Koehring Dandie 5-S mixer, also known as the *"One Bag Speedster,"* is announced by the *Koehring Company,* Milwaukee, Wisconsin, in a newly issued broadside.

Power Hoe Described

The Link-Belt Company power hoe, an improved drag scraper, is covered in *Book 666,* showing its use in coal, stone and sand installations.

Lehigh Literature

The Lehigh Portland Cement Company, Allentown, Pennsylvania, is distributing to concrete-products users of its cement elaborate promotional literature in the shape of folders, blotters, and reproductions of advertisements for window display.

Conveying Systems

Book No. 575, published by the *Link-Belt Company,* covers a variety of systems of elevating and conveying machinery. It is well illustrated with photographs.

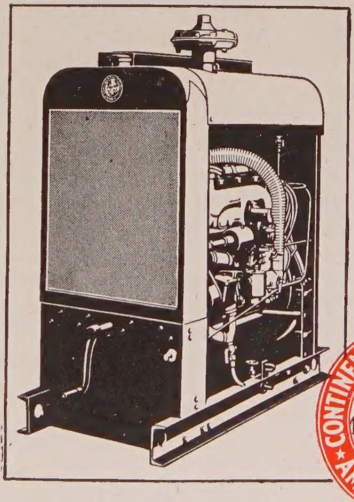
Greater Daily Output

Whether you are engaged in contracting, mining, railroading, oil field development or manufacturing, a greater daily output means greater profits.

Heavy Duty Red Seal Continental Motors furnish the dependable power so vital in getting things done quickly and economically—in accomplishing results in the industrial field. Wherever gasoline power is employed and industry functions, Heavy Duty Red Seal Continental Motors, because they are designed for the purpose intended, give the maximum of profitable satisfaction through years of continuous service.

CONTINENTAL MOTORS CORPORATION
INDUSTRIAL DIVISION
Offices: Detroit, Michigan, U. S. A.
Factories: Detroit and Muskegon

The Largest Exclusive Motor Manufacturer in the World



Top view shows Foote Road Paver powered with a Continental Motor. Lower view gold medal awarded the Foote Co. by the American Institute of New York.

CONTINENTAL MOTORS
Powerful as the Nation
AMERICA'S STANDARD

Continental Motors

Mixer Musings

Reported by "Joe"—The Mixer Boss.

The First Slump Test

CONCLUSIVE evidence of the making of the first slump test is now in the hands of the Keeper of the Records. Letters, dusty with the neglect of years, have been exhumed from the files. Now copies of them repose in the archives of the ***Guild***.

Here is the story of the FIRST SLUMP TEST.

It was made in the winter of 1913-14. Sanford E. Thompson was at that time chairman of the Committee on Concrete of the American Concrete Institute. At a meeting in New York, Mr. Thompson brought up the matter of *consistency* and deplored the lack of any method for determining it. He was then preparing directions for making a large number of test specimens for certain experiments that would be made by laboratories scattered all over the country.

It was necessary in that case to have these specimens molded by the different laboratories of about the same *consistency*, but there was no way of specifying what that consistency should be. To simply specify the water content would be inadequate because the fine aggregate to be used by the various co-operating laboratories would vary greatly in fineness. Mr. Thompson said that he used in his laboratory a consistency which was such that a handful of the mixed concrete was wet enough to hold together. It could be formed in a ball and passed from one hand to the other without falling to pieces and without being pasty.

Our Grand High Truncated Cone, Cloyd M. Chapman, C.S.T., discussed this problem with Mr. Thompson. Then he went to the WCK laboratory and, after thinking about the problem, made a form out of a short piece of galvanized leader pipe, 4 inches in diameter and 6 inches long. He filled this with concrete while it was standing upright on a glass plate. Then he lifted the form from the concrete to see if the concrete would stand upright on the plate without the form—

AND lo! the ***First Slump Test*** was made!

After trying several consistencies in this manner, he found that there was a very definite point at which the concrete without the form would not hold its shape, but would slump down somewhat. He found, also, that a cylindrical form sometimes dragged on the concrete while lifting the form, distorting the shape of the concrete. He then changed the form by making it slightly smaller at the top—about 3¾ inches at the top and 4 inches at the bottom. This form lifted without dragging on the coarse aggregate of the specimen.

Our Grand High Truncated Cone is therefore well named. For it was he that devised the truncated cone as the most satisfactory method of making the slump test.

Next Mr. Chapman, C.S.T., wrote a description of this method of test to Mr. Thompson and the method was used by the co-operating laboratories in making the series of tests then under consideration.

Proof of this epoch-making event lies in the archives of the ***Guild of Certified Slump Testers***. Thus, unheralded and unsung, a great event, destined to play one of the most important parts in concrete construction saw the light of day.

Too much honor cannot be given to the Grand High Truncated Cone!

Joe, the Mixer Boss.
Keeper of the Records.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 West Thirty-ninth St., New York City.

American Road Builders' Association; Wm. H. Connell, President, Miss E. A. Birchland, Secretary, 29 W. 39th St., New York City.

American Society for Testing Materials, C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer Secretary, 1150 Munsey Bldg., Washington, D. C.

Associated Metal Lath Manufacturers; 123 West Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference: H. E. Plummer, President, J. F. Downey, City Hall, Cambridge, Mass., Secretary.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.

Concrete Products Association; S. I. Crew, Cincinnati, Ohio; D. R. Collins, Secretary, 47th and State Streets, Alois Postoffice, Milwaukee, Wis.

Iowa Concrete Products Association; Floyd Goodrich, President; R. L. Gavin, Secretary-Treasurer, 405 Hubbell Bldg., Des Moines, Iowa.

National Association of Building Trades Employers; A. E. Coleman, President; A. W. Dickson, Executive Secretary. 2226 Builders Building, Chicago, Illinois.

National Association of Builders' Exchanges; William F. Chew, Baltimore, President; Earl F. Stokes, Secretary, 15 East Fayette St., Baltimore, Md.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East Twenty-second St., New York City.

The National Lime Association: Burton A. Ford, Secretary, 927 15th Street, N. W., Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 933 Leader-News Building, Cleveland, Ohio.

National Sand and Gravel Association, V. P. Ahearn, Executive Secretary, 432 Munsey Bldg., Washington, D. C.

Nebraska Concrete Products Association; A. V. Anderson, President, Reimers-Kaufman Co., Lincoln, Neb.; E. L. Bateman, Secretary, Bethany, Neb.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, 111 W. Jackson Blvd., Chicago, Ill.

Wisconsin Concrete Products Association; A. P. Kuranz, Secretary-Treasurer, 425 E. Water St., Milwaukee.